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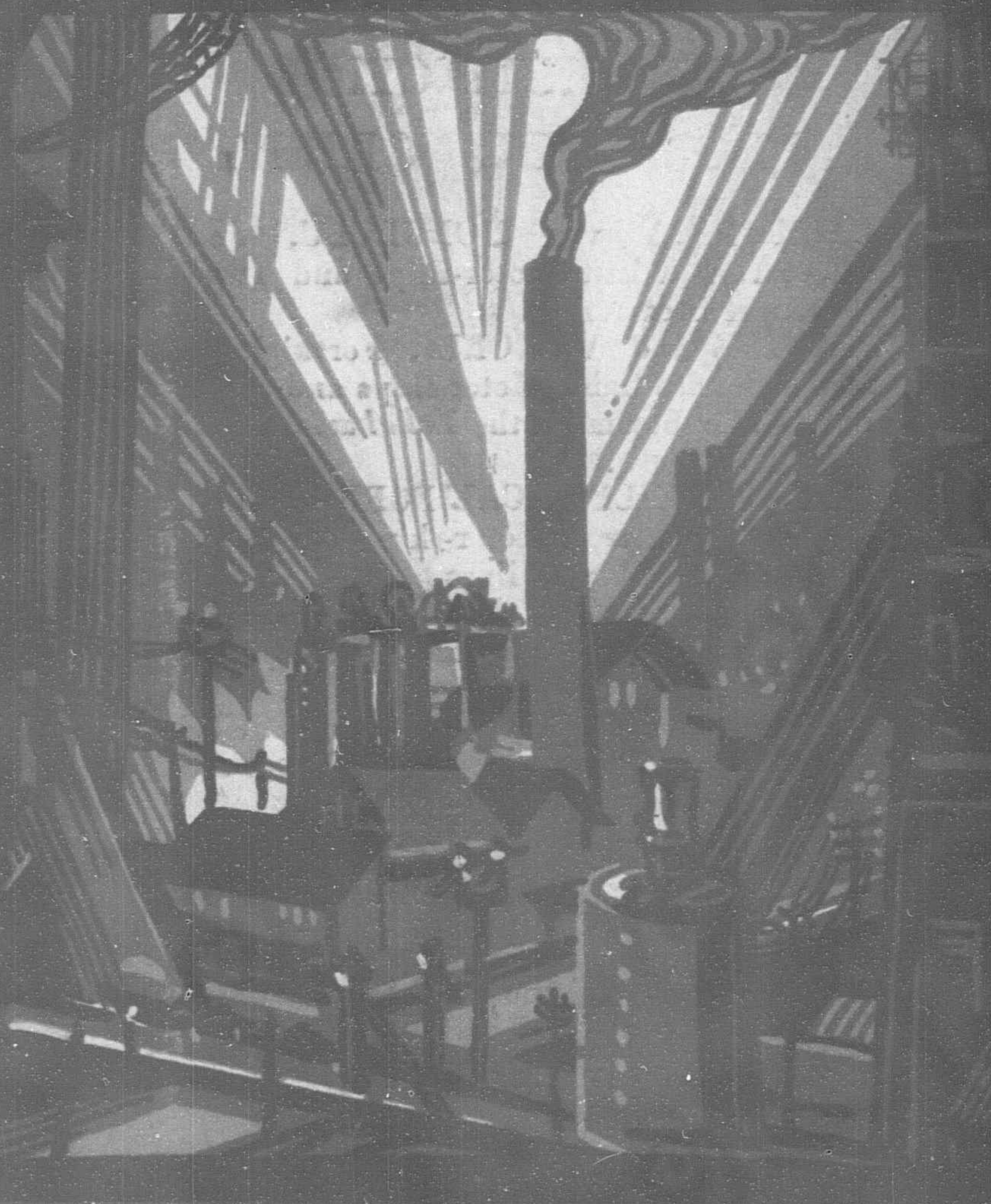

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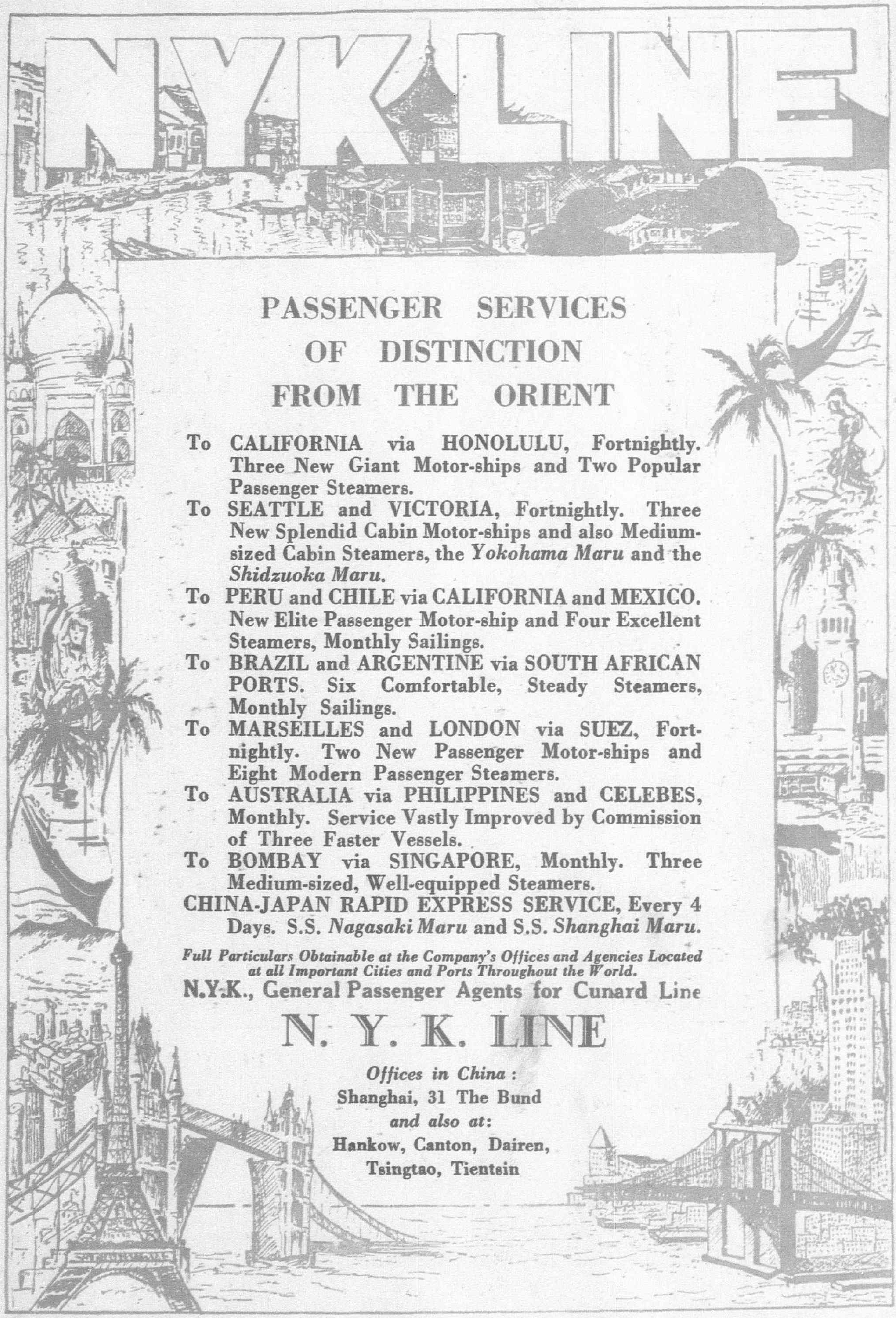
遠東時報

A Possible Solution for China's Problem

Vol. XXVII JULY, 1931 No. 7



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The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXVII SHANGHAI, JULY, 1931 No. 7

A Possible Solution

By GEO. BRONSON REA

"*We cannot apply one principle in one part of the world and another in another part.*" So declared Sir Edward Grey defending British policy in China in the House of Commons just previous to the outbreak of the World War. A year later, discussing problems of China arising out of the Twenty One Demands with the spokesman for the French Foreign Office, the writer quoted Sir Edward Grey and was told that "*principles that apply in Europe do not extend to Asia.*"

At the Paris Peace Conference, the vital principle of America's basic defensive policy expressed in the Monroe Doctrine was passed by a bare majority in the Council of Ten and incorporated in the Covenant of the League, but when Japan advanced her claim to racial equality and it also received a majority of votes, President Wilson imposed the rule of unanimity. Recognition of the principle which would have solved the basic problem of Japan was rejected. "*Principles which apply in America do not apply to Asia.*"

The Great War brought into existence the League of Nations and the World Court for the preservation of world peace, but the failure of the United States to join the League together with the exclusion of Russia, made necessary some new international understanding to eliminate war as an instrument of national policy. So we have the Kellogg-Briand Peace Pact, which provides no machinery for the settlement of international disputes or for their prevention.

Theoretically, local wars are no longer possible. Every such outbreak is considered as a menace to world peace. No question likely to disturb the peace of the world can be admitted to be the private concern of any two parties to a dispute. In some way or other a purely private fight soon becomes a free-for-all. The main object of these war renunciation pacts being the preservation of the *post-bellum status quo* in Europe no consideration has been given to problems affecting the security of China or Japan.

'Tis a mad world! No two nations can be permitted to engage in hostilities without the immediate intervention of all the other signatories to the Peace Pact. But any single nation can go to war within itself, violate all the laws of civilized warfare; ravage and lay waste its own territory; outrage, torture and massacre millions of defenceless people and condemn other countless millions to death by starvation and there is no law, agreement, pact or understanding between the great "peace-loving Powers" providing for even a united protest in the name of humanity!

A Chinese war-lord may quarter his army upon a province, seize the food and crops of its inhabitants—even to their seed grain—and remain immune from censure, while millions of unfortunate people die of starvation and their wives and daughters are sold into slavery to fill the bagnios of the coast cities. As these victims pass through the likin stations and over the provincial borders *en route* to their destination, a head tax is collected on the traffic to swell the revenues of the Attila who brought this fate upon them. Such was the picture of Shensi and Shansi revealed last year by the investigators of the famine areas.

No food could be sent from abroad to the starving millions; no protest was uttered in behalf of these victims of a war-lord's rapacity; nothing was done to stop the traffic in human beings. The cry of distress, the appeals for succour arising from the millions of helpless starving people fell on deaf ears. The laws of humanity could not be extended to China without violating her sovereignty! *Principles that apply in Europe and America do not apply in Asia.*

But, if one of these women be transported across the seas and sold into a Chinese house of ill-fame, in Singapore, San Francisco, London, or elsewhere, it at once becomes a violation of the International Mann Act and Geneva sends out a commission to investigate. Not a word of protest against conditions which create the traffic. That is nobody's concern—a violation of China's sovereignty. Only when the victims cross the border of China does the traffic become the affair of the rest of the world. Then, and only then, does the guardian of international morality raise its voice in horrified protest and dispatch its policemen to enforce the law.

A localized war may place in jeopardy the peace of the world, upset the delicate balance of power, precipitate economic disturbances and in other ways bring disaster upon neutrals, and it becomes the immediate concern of all nations, but an interminable internecine struggle involving one quarter of the world's population which may change the political complexion of Asia, become a menace to civilization and drag a neighbor down to ruin is not a matter for outside interference. The long drawn out devastating civil wars in China for power, pillage and place do not endanger the security of Europe or America, but are dragging Japan down to economic disaster and undermining her status as a first class power. A similar war in Europe would unite all neighboring nations in a common program to protect themselves. In Latin America disturbances on a much smaller scale that menaced the strategic security or economic life of the United States would call for some interpretation of the Monroe Doctrine and justifying immediate American intervention. *Principles which apply in Europe and America do not apply to Asia.*

For years, the world has been watching the gradual disintegration of China into a group of feudatory and militaristic states with the power of government and taxation, of life and death, of peace or war concentrated in the hands of petty tyrants whose rule is upheld, and perpetuated by armed force. For years we have witnessed these armies grow and expand until to-day they outnumber all the other armed forces of the world. For years, we have sat silently by and witnessed the spoliation and degradation of a hard-working, peaceful, lovable people. We have seen them taxed to death, enslaved, starved, outraged and massacred and not a voice has been raised in their behalf. We have watched the gradual impoverishment of a nation, the ruin of its credit, the destruction of its wealth, the collapse of its purchasing power, the spread of anarchy and despair until now the only remedy for restoring even a semblance of law and order is the wholesale slaughter of the armies of "hungry people," ravaging and looting the countryside under the banner of a foreign political creed whose principles can never find root in the hearts of the people.

Billions upon billions of dollars have been wrung from the people of China to rivet firmly upon their necks the yokes of their inhuman taskmasters. All the money that can be raised by increased customs tariffs, loans, confiscation of property, capital levies, unsecured paper notes, opium, vice and other devious and questionable methods, goes into the insatiable maw of the military Frankenstein that China has devised for her own destruction. While President Hoover declares a moratorium of international war debts as a preliminary step in his greater program for reduction of world armies, President Chiang Kai-shek proclaims that his forces are too small for his needs and will be increased instead of reduced!

So we come again to a clash of principles between the Democracy of the West and the pseudo-Republicanism of the East. The National Government of the Republic of China is a military despotism pure and simple, maintaining itself in power by the preponderance of its armed forces. Last year, it fought a major war against the Northern Feng-Yen coalition and exhausted itself. This year, it is engaged in another life and death struggle to maintain its power against the communist and bandit armies which control the pivotal strategic provinces of Kiangsi and Hunan. If successful, it must then turn its attention to Kwangtung and Kwangsi and then carry the war into Szechuan, into the Northwest and the regions north of the Yellow River. Peace in China can be attained only after a series of Napoleonic wars more devastating and more apalling in their toll of human lives and destruction of wealth than the historic campaigns of the Conqueror of Europe. If ever united by force China will emerge from her internal struggles with the largest armies in the world; armies that may not be reduced or retired from the conquered provinces.

To China's internal problems is added the constant pressure of the expanding Soviet on her outlying provinces. Mongolia is now an independent Soviet republic closely tied to Moscow; Hsinkiang has been brought within the sphere of Soviet economic influence and will follow the same road; the Barga region is asserting its right to independence; black clouds are forming in Kirin and South Manchuria; yet the five million men under arms in China continue to fight among themselves for the privilege of looting their own people. This however is China's own business, the prerogatives of her sovereignty. No outside nation has the right to utter a protest, offer mediation, suggest a truce or interfere in behalf of humanity or peace.

The Chinese can continue to kill each other to their heart's content, to violate all the laws of humanity, drag down to ruin their neighbors and remain immune to outside intervention. Two nations that start brawling and fighting become a menace to world peace. International policemen appear as by magic, club them into submission and hale them before the World Court for a settlement of their dispute.

A single nation exercising its sovereign rights to do as it pleases, can start a murderous war within its own borders, outraging all the rules of civilized warfare and the rights of non-combatants; imperil the lives and properties of other nationals; indulge in secret economic wars and boycotts against those nations which interfere for the protection of their subjects; flout its treaty obligations; default on its loans; refuse to pay its debts, and in general become an international nuisance and a menace to world peace and security and, it is nobody's business. Other nations look on with gaping mouths, wondering what it is all about and when it will end. They can see that sooner or later some of the onlookers will be swept into the saturnalia of death and killed; that some incident will arise to precipitate a crisis with an outside power. Then the purely private fight will become the immediate concern of all the others and international policemen will appear on the scene to preserve the peace! *Principles that apply in Europe or America do not apply in Asia.*

But, suppose that China were split into three or four independent states; that the principle of self-determination that underlies the creation of several new European states is extended to the people of South China, to those of the Yangtze regions and those of North China and Manchuria; that the Powers recognize these new states and enter into treaty relations with their governments on the condition that each state agrees to assume its proportionate share of the foreign debt, join the League of Nations and subscribe to be Kellogg-Briand Pact.

Then when these new Chinese states start brawling and warring upon each other their dispute at once becomes the concern of all other nations, a menace to world peace, justifying immediate intervention of the foreign Powers. Then, and only then, can the present interminable struggle for power be brought to a conclusion by outside pressure. Otherwise it must continue until some faction imposes its authority by force of arms, giving birth to a formidable military autocracy dominated by some meglomaniac deluded into a belief that he is a second Ghengis Khan or the Napoleon of Asia.

Nanking is manifestly powerless to exercise jurisdiction over the whole of China. Its recognition as the sovereign authority of the country is the greatest diplomatic blunder of the century. Canton has declared its independence. Manchuria is already independent, linked to Nanking by the terms of a military agreement or truce imposed by sheer financial exhaustion on both sides. The death or permanent disability of either Chiang Kai-shek or Chang Hsueh-liang or their elimination as political factors would be the signal for both sides to renew the struggle for supremacy. Generalissimo Chiang may be the nominal ruler of a " united China " but Marshal Chang is the co-ruler, of equal rank and power. All important edicts, laws, manifestos and military orders must bear his signature. There is no misconception of his status amongst the Chinese. He is the independent, sovereign overlord of Manchuria and North China.

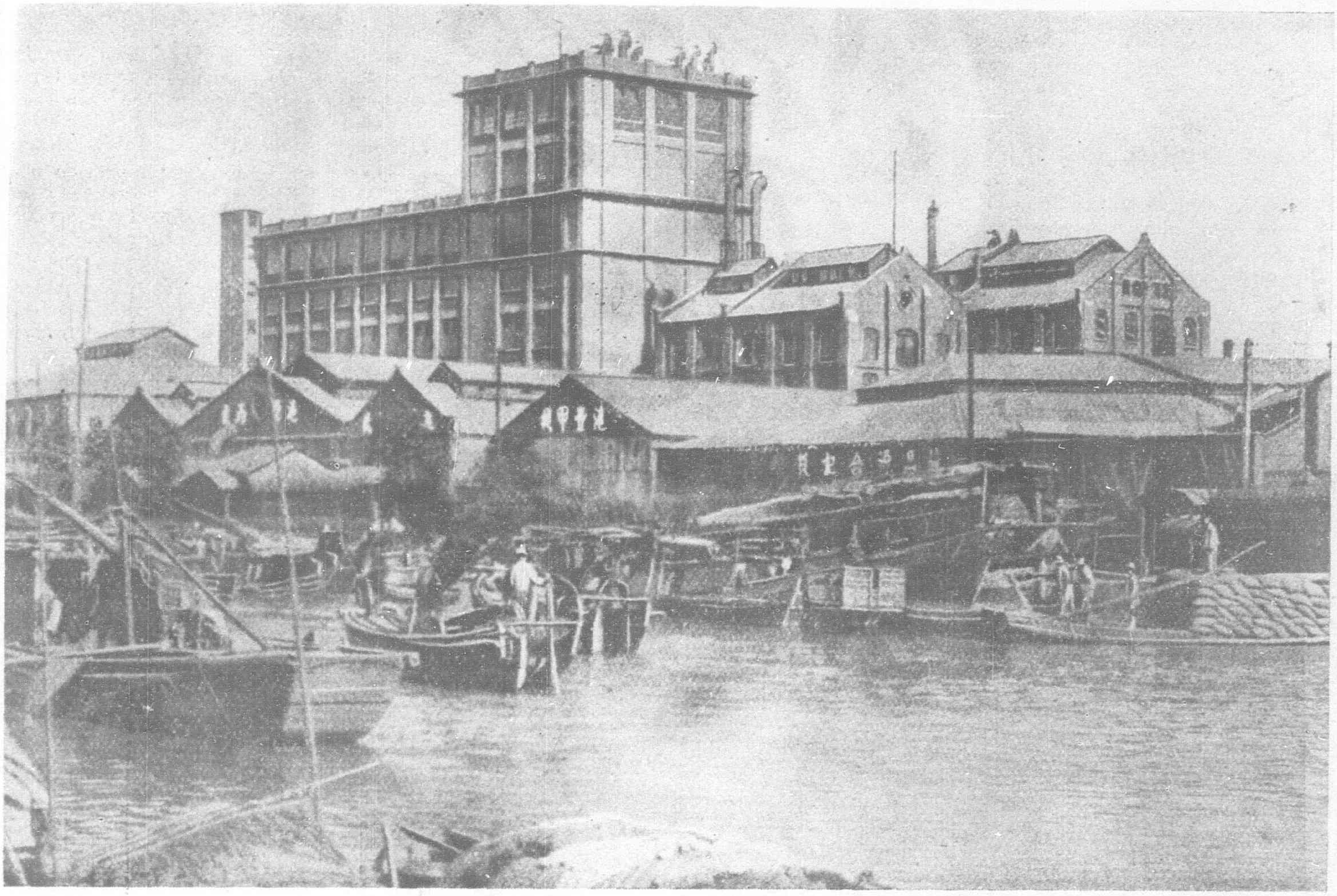
The northwestern provinces are semi-independent. Szechuan straddles the fence while Yunnan for all practical political purposes, has been an independent state since the first revolution.

As long as the Powers insist upon applying a principle in Asia that they discarded at Versailles in order to bring peace and security to Europe, the wars of China will continue to menace the stability of the world. If the application of the principle of self-determination was deemed essential to the peace of one continent, it should be extended to assure peace in another continent. You can't apply one principle in one part of the world and another in another part, and get away with it.

Many remedies have been suggested to restore internal peace in China but all have been rejected by the Chinese themselves who insist upon the right to solve their problems in their own way. They refuse to compromise, to compound their difficulties, to get together and unite. Every year some faction breaks away from the central authority and proclaims its independence, notifying foreign governments that it will not recognize any treaty, loan or engagement contracted with the recognized government. The wars go on. Millions of people are sacrificed. The country is impoverished to feed the armies and pay the huge bills for imported munitions. Problems of grave international import are engendered. A neighboring nation, relying mainly upon China for its raw materials and as a market for its manufactured products is being economically strangled and brought face to face with industrial disaster. Her treaty rights and interests in Manchuria her strategic and economic security are placed in jeopardy by the slow, steady relentless force of Soviet attrition on China's outlying territories. Nanking cannot discharge its treaty obligations in a territory over which it exercises no control. In the last analysis, Japan must look to the Manchurian authorities for guarantees that Nanking is powerless to extend.

Japan is compelled to negotiate with Mukden as an independent state over these vital questions. In other words, Manchuria is independent, Canton is independent, Nanking is independent. Why not recognize the realities of the situation. If the Powers should jointly notify the warring factions that unless an immediate compounding of their disputes is effected recognition will be extended to Canton, Nanking, Peking and Mukden as independent states, it would result in a cessation of hostilities under some agreement that would make for permanent unification. Or, if no compromise is possible; if Canton insists upon exercising its right to apply the principle of self-determination; if Manchuria refuses to submit to the rule of Nanking; then in the name of common sense, of suffering humanity, of world peace and economic stability, the Powers should extend to China the principles they laid down at Versailles for their own security and welfare in Europe. China's internal troubles will then become the immediate concern of all the Powers.

Outside nations will have the right to intervene and put a stop to these insensate civil wars whose toll in lives and human suffering far exceeds the ravages of the World War. Then, and only then, can the world look forward to a prolonged peace in Asia and the economic rehabilitation of a ruined people under the guarantees of the League of Nations, the World Court and the Kellogg-Briand Pact.



The new Fou Foong Flour Mill at 25 Mokashan Road as seen from Soochow Creek

The Fou Foong Flour Mill

China's Largest and Most Modern Mill Installed by Messrs. Henry Simon, Ltd., Flour Mill and Grain Handling Engineers of Cheadle Heath, Stockport, England

SHANGHAI must now rank as one of the large flour milling centers of the world, and the Fou Foong Flour Mill Co. holds the distinction of being the oldest established firm in business to-day.

The Point Mill, built by Messrs. Henry Simon Ltd., and originally operated by a British firm was first in the field by a few months, but this company owing to a business failure has long ceased to be numbered among the Shanghai milling concerns.

The origin of the Fou Foong Flour Mill Co. dates back to 1897, when two gentlemen, Mr. Li-sheng Sun and his brother Mr. Ying-ting Sun, members of an old and distinguished Anhwei family, realiezd that there was a big future for modern roller flour milling plants in China. After studying the possibilities carefully they founded the company in the following year with their uncle, Mr. C. Y. Sun, and several other relatives and friends. The capital of the company was Shanghai Taels 300,000.

Having no previous experience these gentlemen had considerable difficulty in deciding what type of machinery to purchase, what site would be suitable, and the many other problems connected with the initiation of a flour milling business. The present size and prosperity of the firm speak well for the sound judgment they displayed.

Negotiations for the plant were carried on with Messrs. Henry Simon Ltd., but at the time owing to the low cost of the American machinery it was finally decided to go to the U.S.A. to purchase the plant. It is interesting to note that thirty years later, the now fully experienced company have entrusted Messrs. Simon with the building of its large new mill.

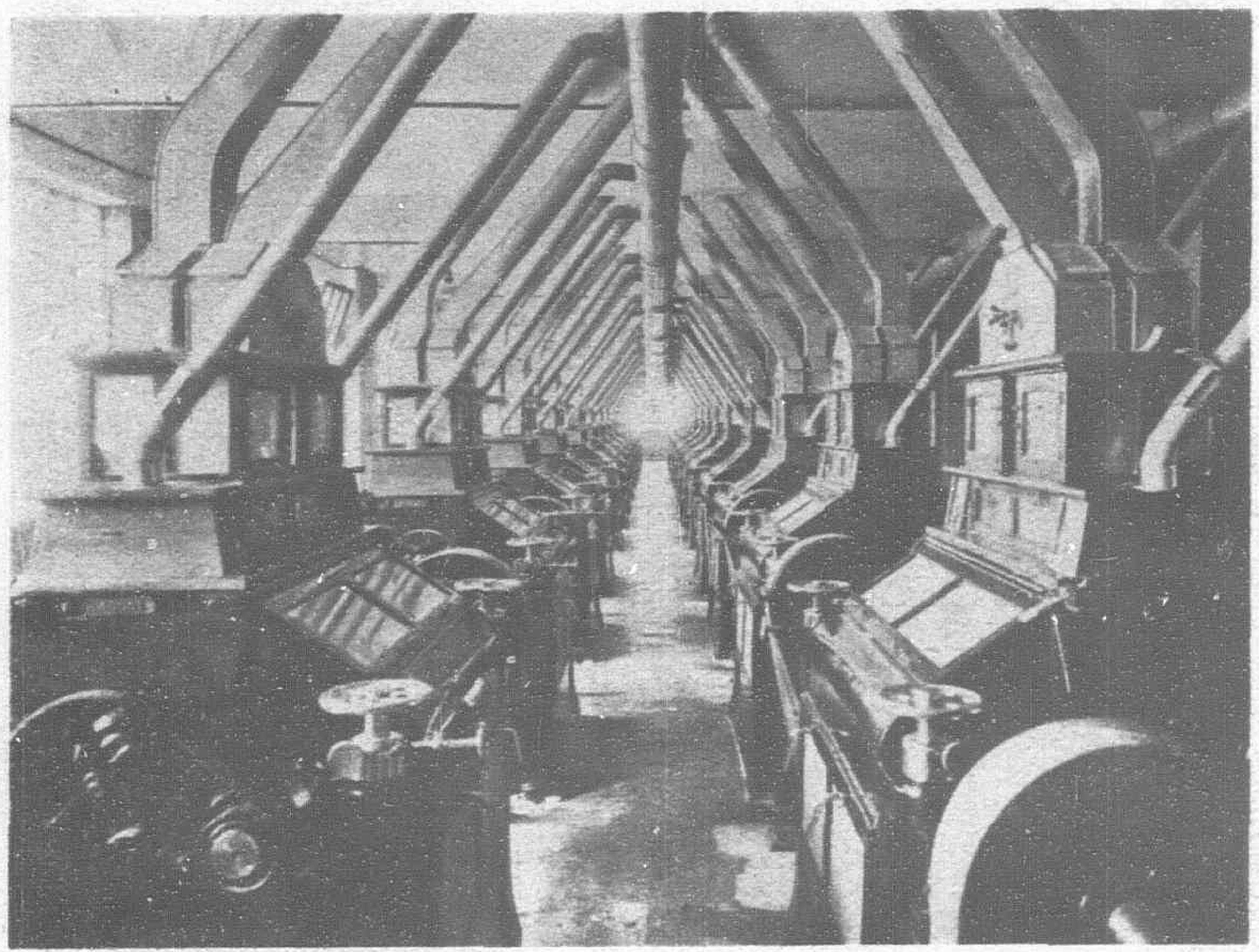
Although he could speak no English, Mr. Li-sheng Sun, undismayed by the difficulties, crossed to America with an interpreter to investigate further the different types of flour milling machinery, and after a stay of six months returned to China with all the necessary plant for a 400 barrel mill, which he had purchased from Messrs. Allis Chalmers at a cost of G. $20,000.

Meanwhile Mr. Ying-ting Sun stayed in Shanghai to organize the company, to purchase the site and to arrange for the necessary buildings. The site chosen has an exceptionally long frontage on a bend of Soochow Creek—one of the most important and busy waterways in the district—and has proved again the foresight displayed by the founders of the firm as it is eminently suitable and is in addition now worth many times the sum originally paid for it.

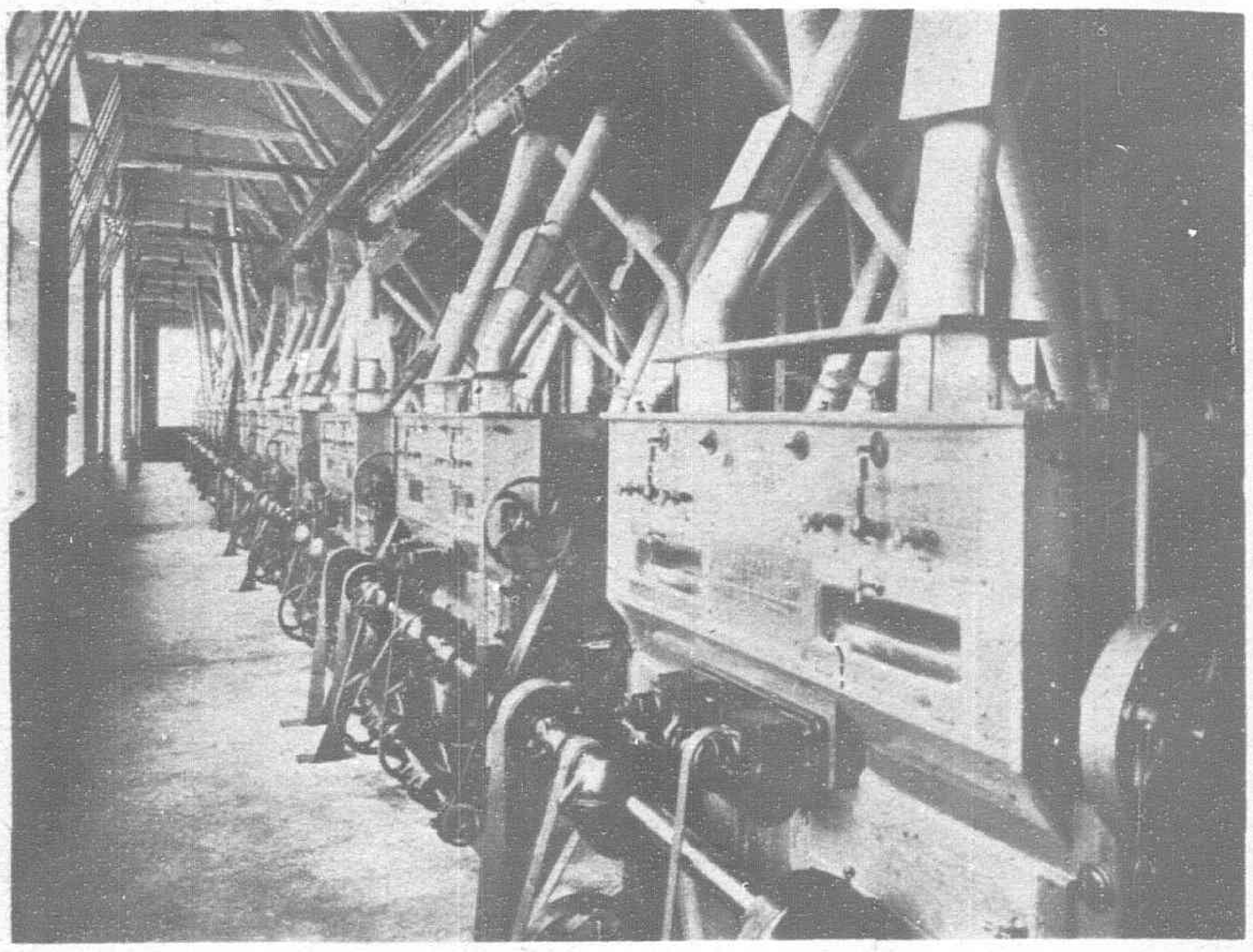
Flour production was actually started in 1900 and a good connection was quickly established, with the result that three years later another complete plant was ordered from Messrs. Allis Chalmers, this time of 1,000 barrels capacity.

The business steadily grew until in 1919 the Company was re-organized. The capital was increased to Taels 1,000,000 and Mr. C. T. Sun, the youngest brother of the founders became President. Under the guidance of this gentleman, a graduate of Cornell University, U.S.A., the company progressed extensively.

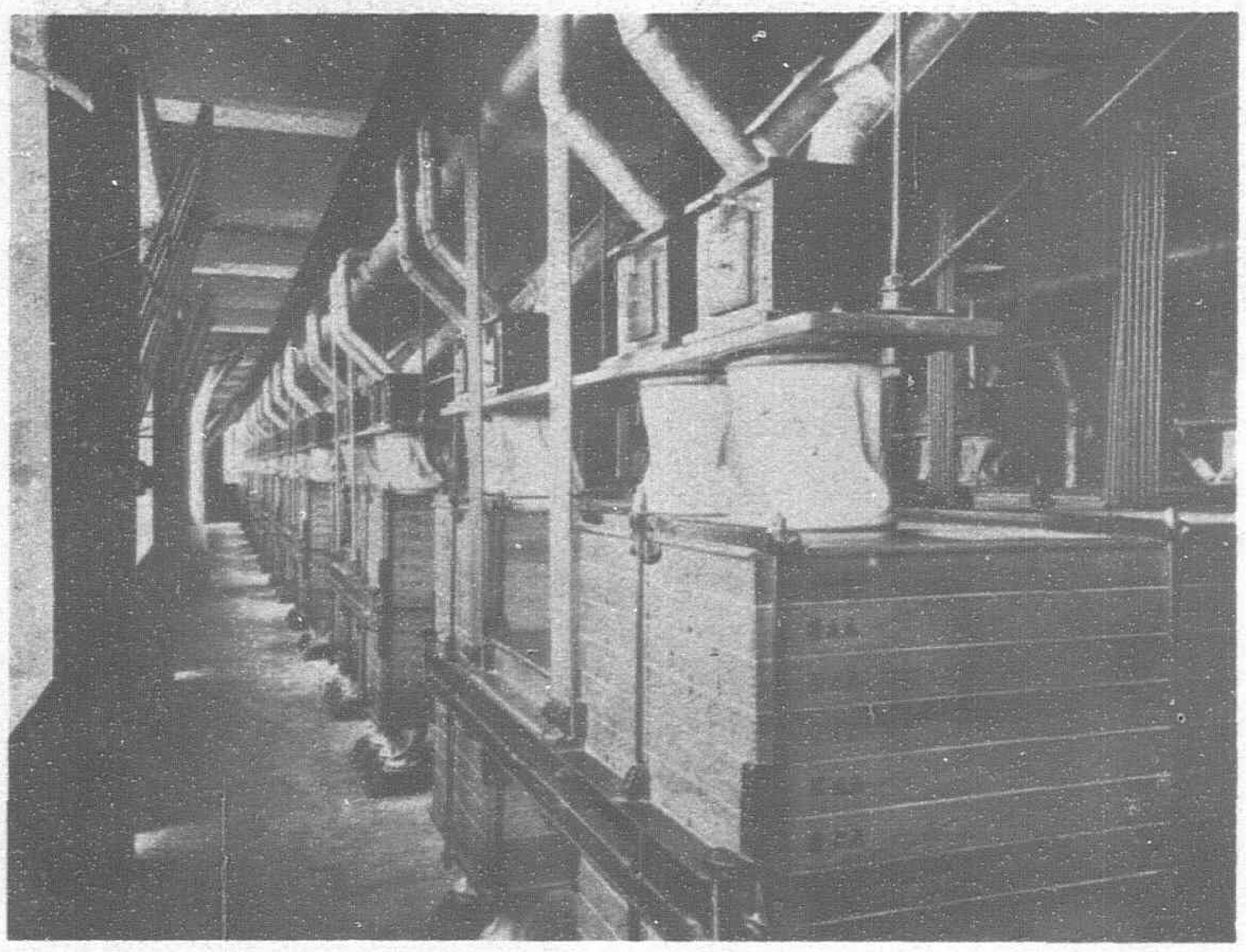
In 1925 Mr. G. A. Sun, eldest son of Mr. Ying-ting Sun, was elected President of the company with his cousins, Mr. Russell



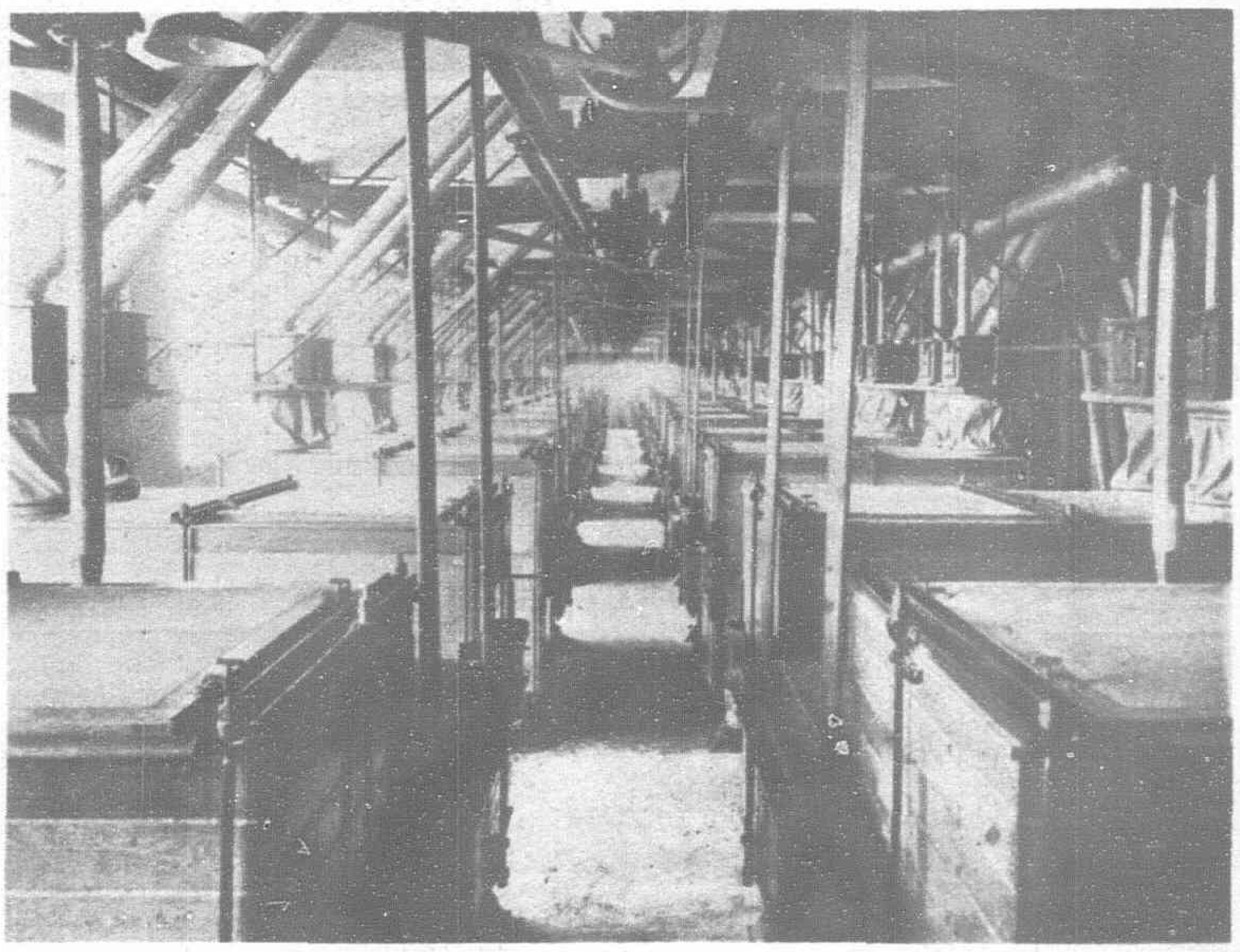
Two of the five lines of Rollermills



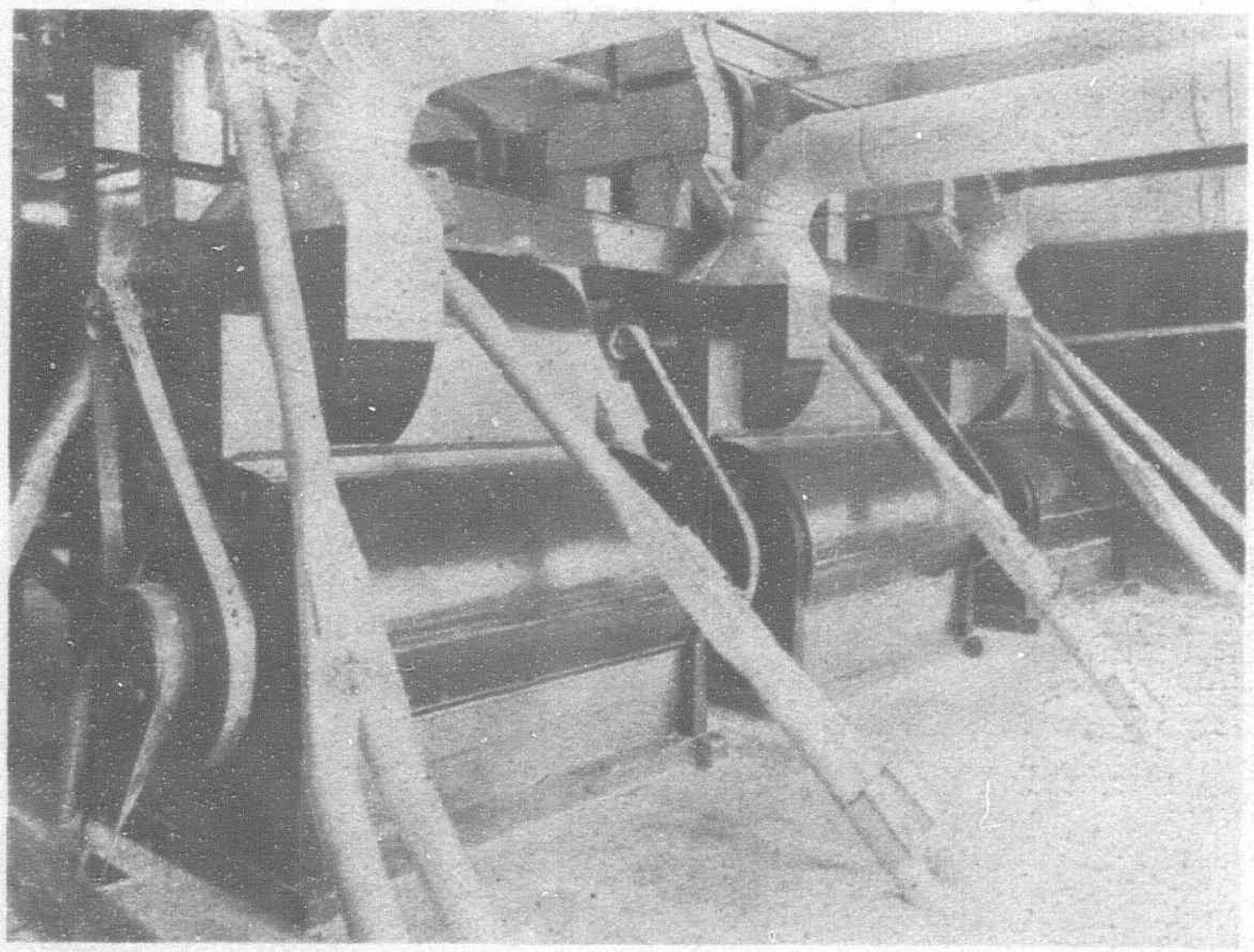
A line of "Simon" Purifiers showing overhead spouting and conveyors



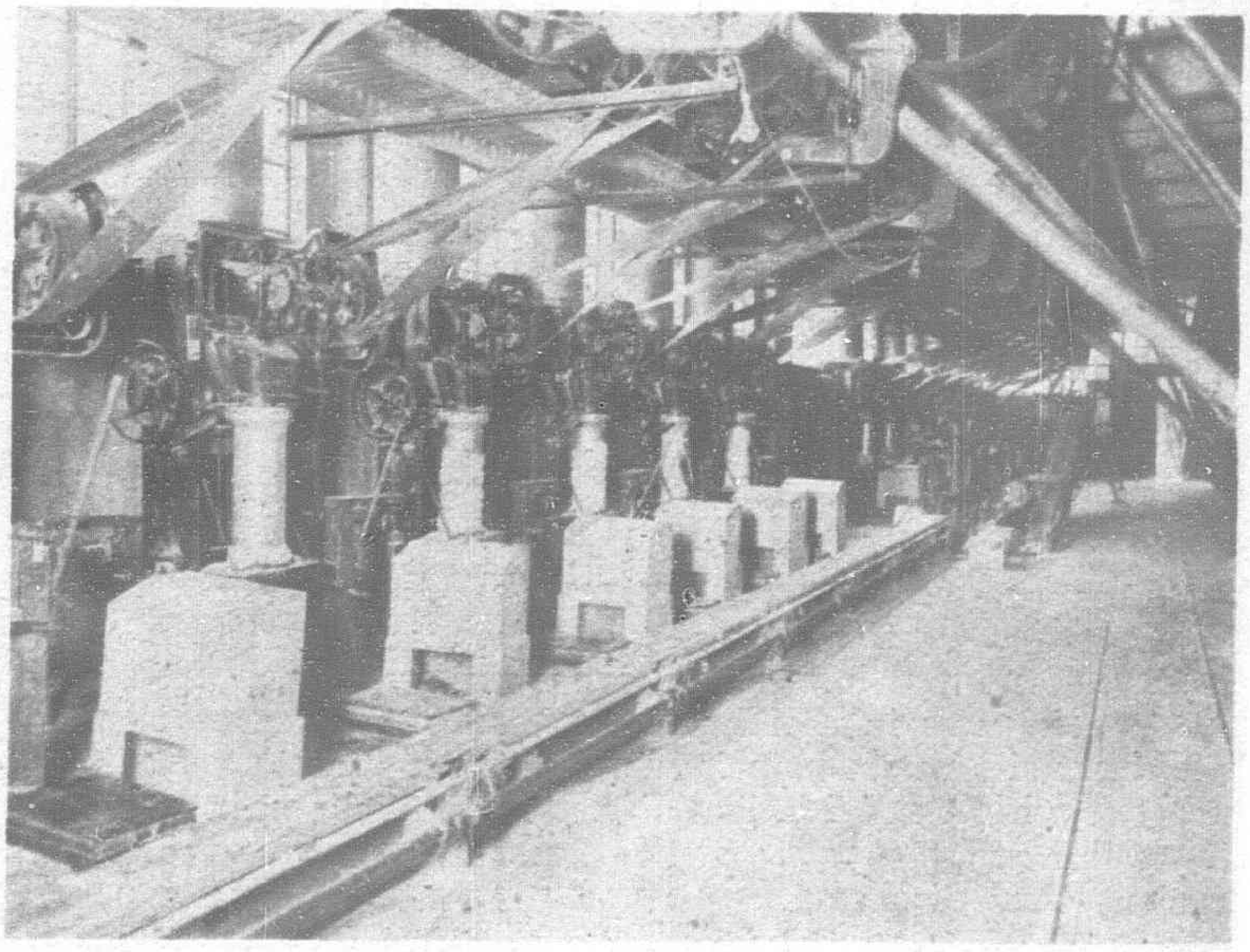
An outer line of sifters



Inner lines of sifters showing method of spouting and exhaust



"Simon" patent Germinal Brush machines showing exhaust spouts from fans to dust collectors

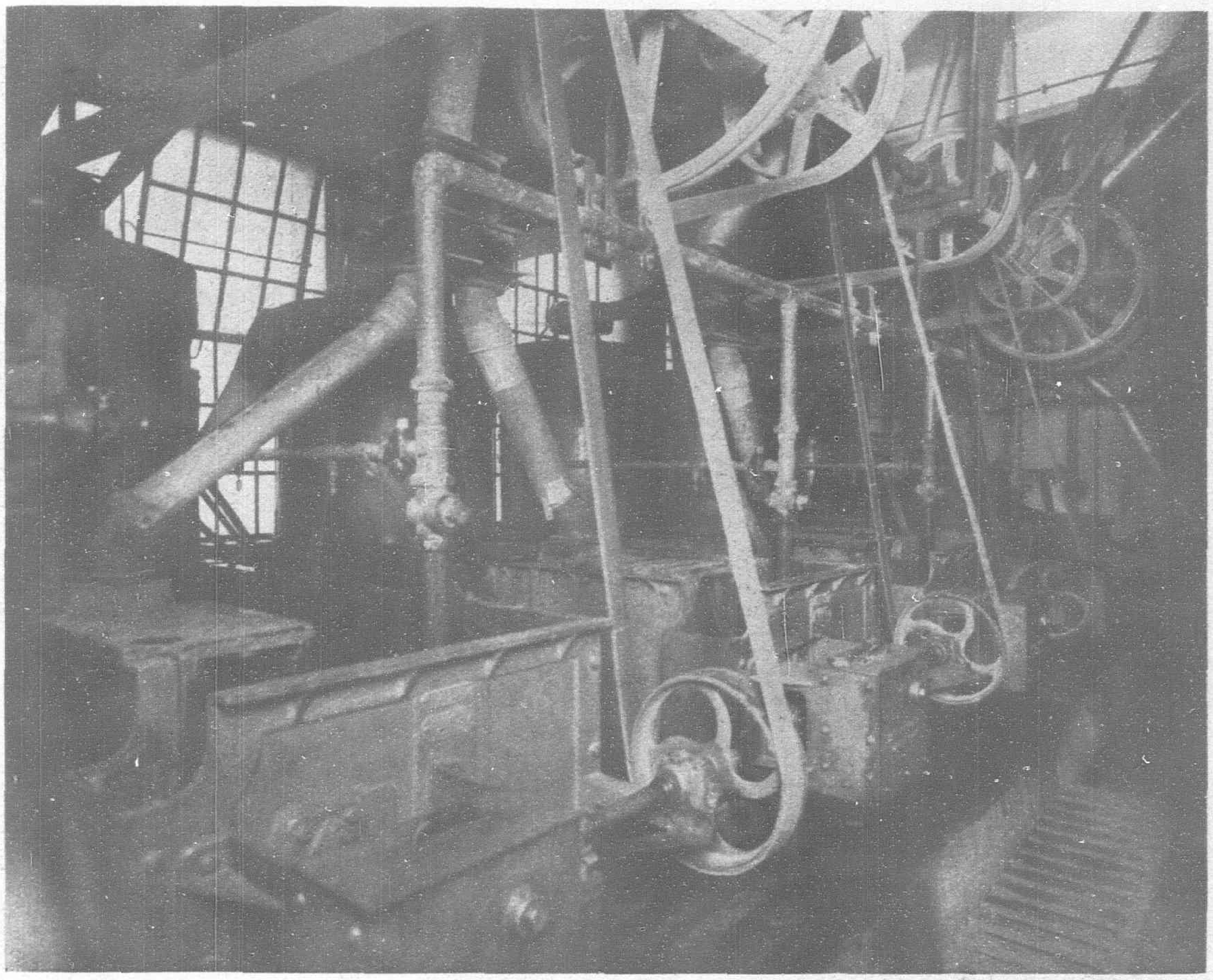


The line of 17 Flour Packers showing the automatic bag sewing machines and band conveyors

Y. Sun as General Manager and Messrs K. F. Sun and Y. P. Sun as Assistant Managers. These gentlemen, who have all received training in various American Universities, are at present directing the operations of the company.

In 1928 the company again decided to increase the milling capacity, and the Directors approved a scheme for the erection of a new 5,000 barrel mill. After careful investigation Messrs. Russell Y. Sun and K. F. Sun negotiated with various American, British and Continental firms of engineers and finally placed the order with Mr. G. H. Akerman, representative for Messrs. Henry Simon Ltd., for a 2,000 barrel mill. At the same time a building was put up to accommodate two plants, one of 2,000 barrels capacity, and one of 3,000 barrels. The 2,000 barrel unit was installed in 1929 and commenced production in August of that year. In order to assist Mr. Akerman, Messrs. Henry Simon Ltd. sent Mr. T. H. Gillett to China at the time the machinery was being shipped, and on completion of the mill he joined the staff of the Fou Foong Flour Mill Co.

After the 2,000 barrel mill had been running for about nine months the order was placed for the 3,000 barrel unit, which has since been installed and was started on June 1, 1931. The start was particularly successful, good flour having been produced after only four hours' running.



The five Combined "Simon's" washers, stoners, and whizzers. These machines do all the washing and *wrincing of the wheat before being sent to the Conditioner Dryers*

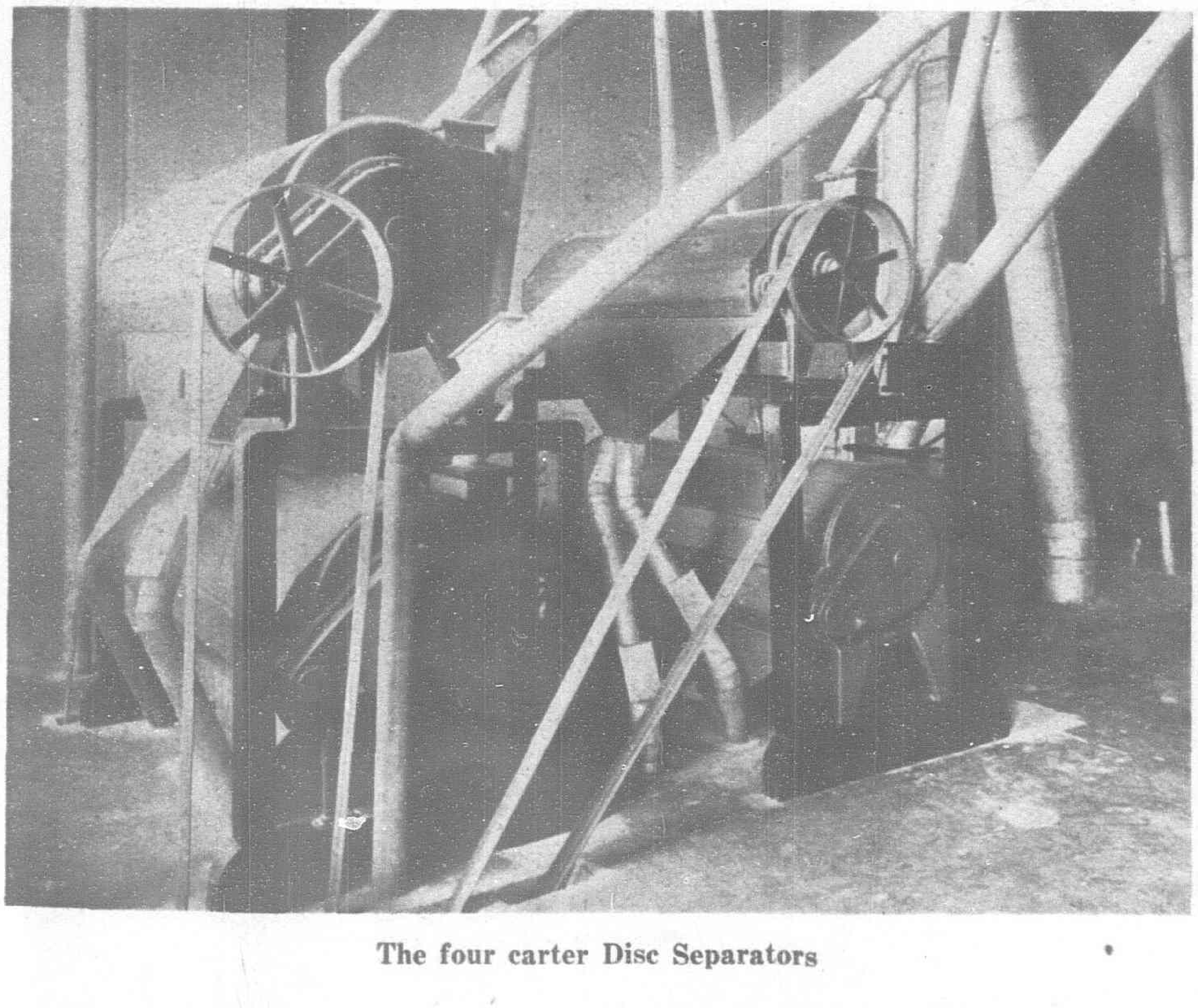
The total capacity of the mills under the control of the company is now about 40,000 bags (each 49 lbs) of flour per day. The principal trade marks being Best Bicycle, Field Gun, Double Tiger, Flying Horse, Magpie, Phoenix, etc., etc. The Best Bicycle flour enjoys a virtual monopoly of the Shanghai trade and is to be seen everywhere about this huge city in all the dealers' shops.

The new plant has a total capacity of approximately 21,500 bags of flour per day, equivalent to 157 sacks (280 lbs) per hour, and differs from all the other local mills in being equipped with a complete washing and conditioning plant.

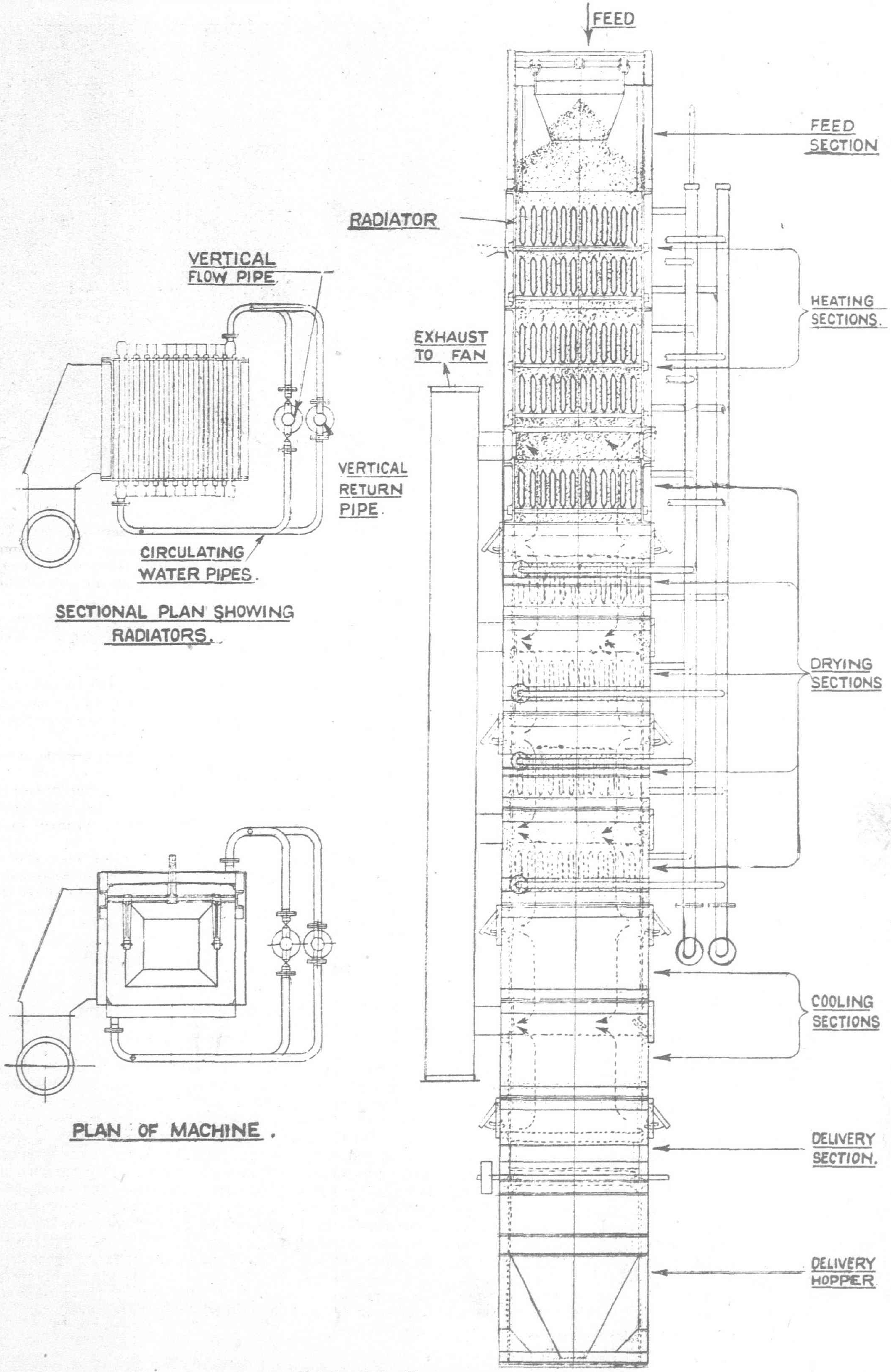
The mill is electrically driven and the motor room is under the wheat cleaning plant, the building for which is on this account two stories higher than the mill. This arrangement allows for the two motors which drive the two milling plants to be coupled direct to one of the line shafts driving the roller mills in each mill. The smaller mill has two lines of shafting driving the roller mills, the second line being driven from the first by a Renold's chain drive which has proved entirely satisfactory. The larger unit has three lines of shafting for this purpose, and here a Renold chain has again been used for one drive and Dick balata ropes for the second.

When the first unit was erected in 1929 considerable doubt was expressed locally as to the wisdom of using balata element rope drives in Shanghai, especially because the climate is so very variable, at one part of the year being very cold and dry and during the summer months particularly hot and humid. The rope drives have proved so satisfactory that they are now being introduced wherever possible in the Fou Foong Co's Mills, and besides this have been installed in a number of other mills in China.

The general arrangement of the wheat cleaning plant is quite straight forward. The wheat from the preliminary cleaning plant is elevated to the top floor and distributed to the seven dirty wheat bins by an 11 inch Redler conveyer. From the bottoms of these bins it is collected by another Redler, and delivered to an elevator which carries it to the roof, and is spouted from here over two King magnetic



The four carter Disc Separators



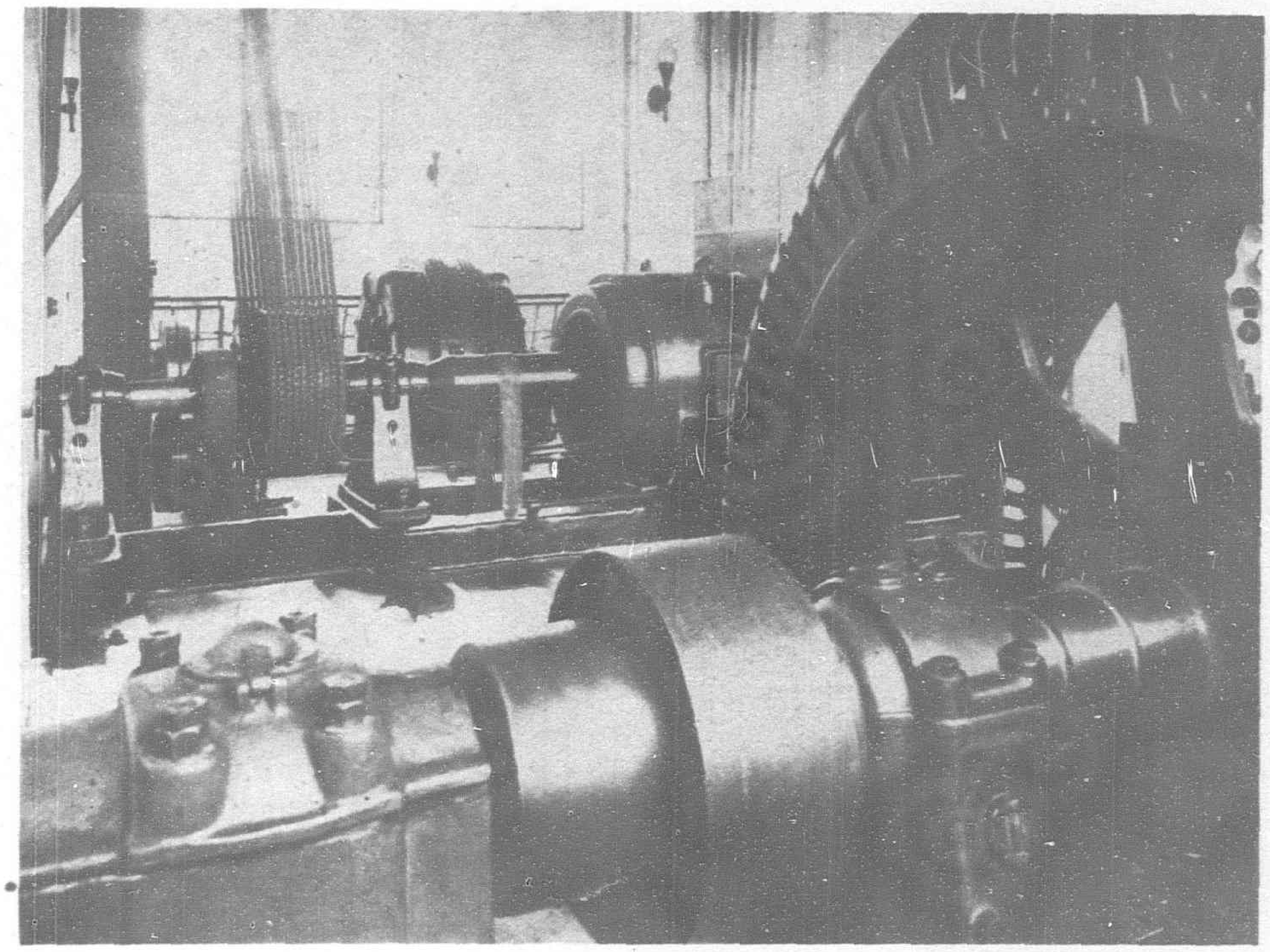
Details of the Simon Conditioner Dryer

separators, which extracts all metal particles, and is then delivered to two No. 7 Juby drive separators. From these machines, the two steams are each divided into three and these fed to six No. 1a, Emery scourers. The wheat is then elevated again and spilt over the five No. 3 Mumford washers each of which feeds one of the latest type 30 qr. conditioner, which are worked on the calorifier system. From the conditioners the wheat passes to the eight conditioning bins.

From these bins the wheat passes over two No. 8 separators and from these to the No. 4 Carter disc separators which extract all small seeds and fine broken wheat from the stream of wheat which finally passes through three No. 7. Iron Prince scourers before going to the grinding bins.

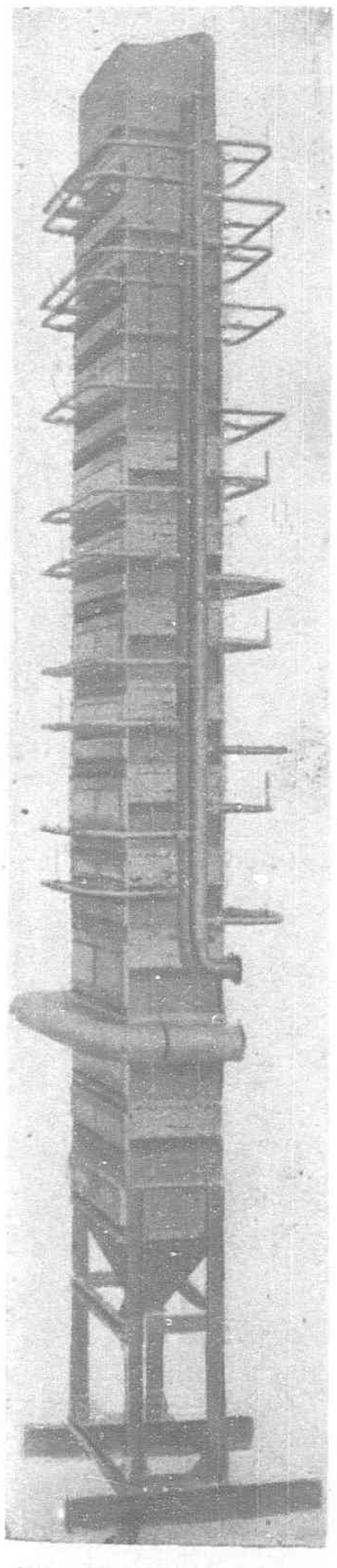
The feed to "A" Mill is regulated by Columbia feed governors, whilst that to "B" Mill is weighed on a Simon automatic weigher.

Both mills are on the "Simon" system, modified and abbreviated to meet the special local conditions. The same general arrangement is adopted in both plants and the resulting complete floors are most attractive.



The Motor Power Room

The ground floor is utilized for flour packing, which is done on 17 packers, adjacent to which run slow conveyors, specially designed to carry the unsewn bags in a vertical position along to the sewing machines. This they do excellently and so far no bag has ever fallen over in its passage along these conveyors unless accidentally hit by somebody. The bag closing is done by four Union special machines, and after passing from these the bags fall off the ends of the slow conveyors on to a small conveyor travelling at right angles to them. This delivers the bags to the fast conveyor which carries them to the warehouses situated alongside the creek.



The Simon Conditioner-Dryer

The Roller floor is a source of much pride and pleasure to those interested in the mill. Every spout and air trunk has been carefully aligned and the whole floor is as symmetrical as it was possible to make it.

The first floor consists of 65-x of the latest type "Simon" Rollermills each machine having two pairs of chilled iron rolls 40 inches long by 10 inches dia. these machines are placed in five rows and it is here where all the grinding and reducing of the meal to flour is done. This floor is a source of much pride and pleasure to those interested in the mill, as the illustration shows every spout and air trunk has been carefully aligned and the whole floor is as symmetrical as it was possible to make it.

The second floor is devoted to spouting and conveyors. The roll grinding and grooving shop is located here as well as the sampling and testing room, and in addition to this there are sixteen No. 7 Niagara bran dusters, ten of which are driven through clutches with a quarter twist balata rope drive which is proving eminently satisfactory.

The purifier floor contains 23 double fanless purifiers and 35 No. 1 3-sht centrifugals.

On the third floor there are 23 double "Simon" fanless purifiers and 23 No. 1. "Simon" 3 Sheet centrifugal flour dressing machines, the purifiers are in two lines one each side of the building, and it is here where the different stocks are divided and purified before being sent down to the rollermills to be ground.

The fifth floor contains 40 plansifters, which do most of the separations and dressing out of the flour, these are arranged in five rows of eight each. Again the utmost care has been taken to keep the spouting alignment good and a most pleasing appearance has resulted, as can be seen in the illustration of this floor. This floor is a source of pleasure to millers and amused bewilderment to other visitors.

The sixth floor contains the fans and dust collectors and the five germinal brush machines which give the wheat a final polish before it goes to the first break rolls.

The spouting and trunking throughout the mill are of metal and a word should be said of the excellent work done by the Chinese tinmen. They work with most indifferent tools, but are most ingenious and extraordinarily quick. They contract for the job and waste no time once they get started.

The floors of the mill are all of concrete, and the whole plant is as nearly fireproof as possible.

The power consumed works out at 1 h.p. for 20 bags capacity (of 49 lbs each) which is very much lower than any other mill in the district and not more than half that is required by some of the mills.

Upon the completion and successful starting up of the new mill both Mr. Akerman and Mr. Gillette were presented by the Fou Foong Co. with silver cups suitably inscribed setting forth the company's appreciation of the services rendered by these gentlemen.

Bibliographie von Japan

1927-1929

Of special interest to all students of Japanese affairs is the announcement of the publication by Messrs. Karl W. Hiersmann, of Leipzig, of Oskar Nachod's "Bibliographie of Japan" for the years 1927-1929, together with a re-publication of a supplementary volume for the years 1906-1926. The work of the author, which is produced in the German language, is based upon years of effort devoted to a study of the people of Japan, their religions, industries and their progress. The earlier volumes of this work are devoted particularly to the economic industrial development of Japan. In a foreword to the present volume the author acknowledges assistance given to him from various sources. These include various German technical and trade journals, Japanese trade and scientific journals, and the *Far Eastern Review* of Shanghai. Appreciation is also expressed to Messrs. S. N. Matweew of Vladivostok and A. D. Popow of Moscow for assistance given in translating the work into Russian.

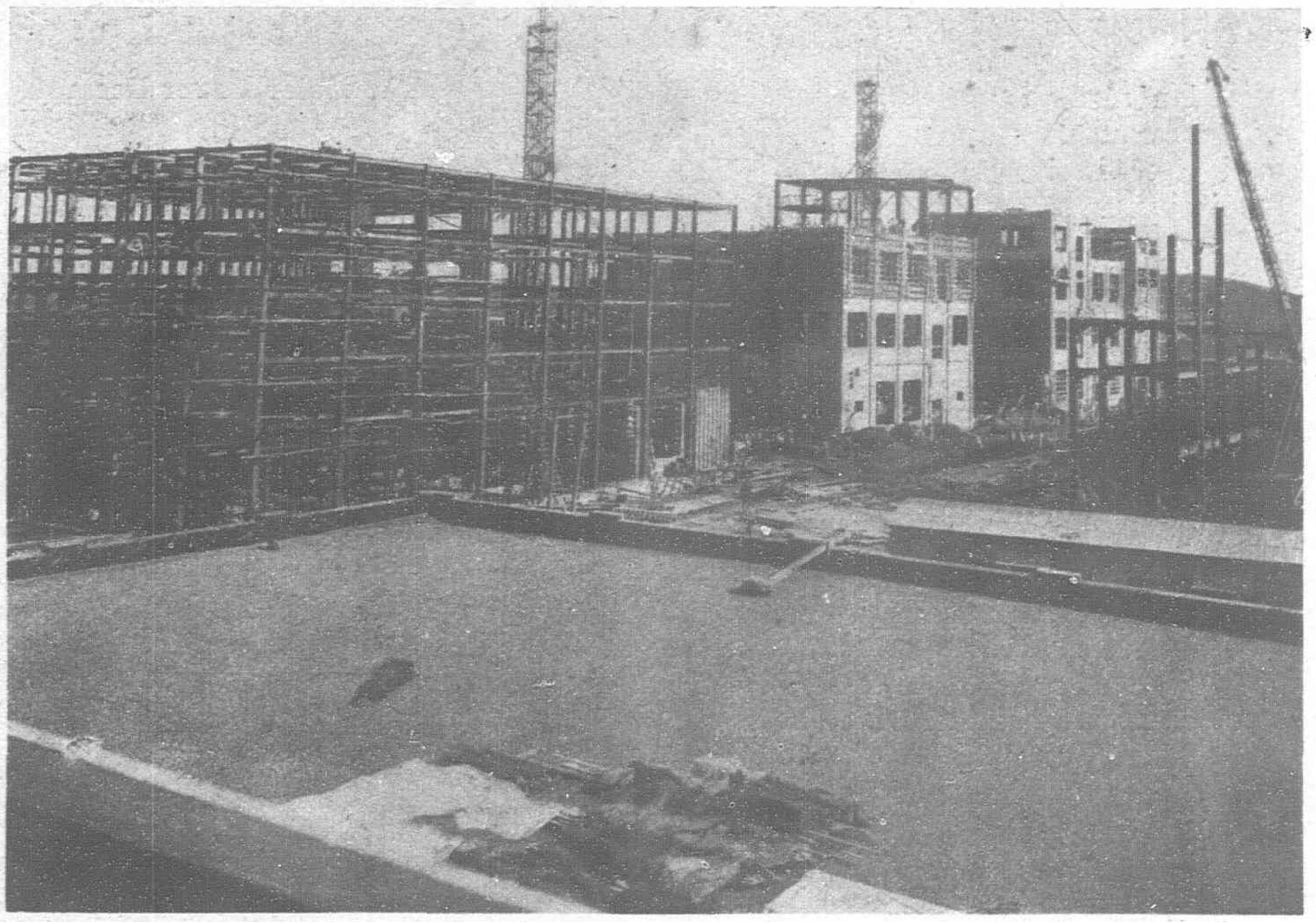
Nippon Corn Products Kabushiki Kaisha

Far Eastern Plant of American Company Begins Operations in Northern Korea

The Corn Products Refining Company, with executive and sales offices in New York, has branch offices and factories located in various cities in the United States. Their largest plant is located at Argo, near Chicago, this factory having a capacity for grinding 85,000 bushels of corn per day. Other American plants are located at Edgewater, New Jersey and at Pekin, Illinois.

For many years this company's products have been sold abroad, and to serve these foreign markets as they have developed, sales offices and branch manufacturing plants have been placed, within the past few years, in all leading European countries. The two latest plants built are in Brazil and in the Argentine. Plants have been purchased for their use in manufacturing in Mexico and in Jugo-Slavia.

Corn Products Refining Company has been doing business in the Orient for approximately 20 years. Of all Oriental countries Japan has always consumed the largest volume of goods, and stands to-day a large potential consumer. To get direct contact with and to better serve Oriental markets, the Company decided to place a plant somewhere in the Far East with capacity of approximately 2,000 bushels per day.



Structural details of part of the plant of the Nippon Corn Products Company at Heijo, Korea, erected by H. K. Ferguson Company of Cleveland, Ohio

Following this preliminary decision further investigations were made, and it was found that industrial possibilities were great and as a result it was definitely decided to build a Far Eastern plant with a capacity for grinding 6,000 bushels per day, planned for future extension to 12,000 bushels per day by small increases and changes in facilities originally provided. This plant is planned to supply the Japan market and other Oriental countries.

Location of Factory

A preliminary survey was made by both sales and engineering representatives of the parent company considering all phases of plant location, this survey covering the island of Hokkaido, all of the main land of Japan, the island of Kyushu, and all of Korea as far north and west as the Manchurian border. All sites investigated were finally reduced to three, one in Hokkaido, another in Kyushu, and the third in northern Korea. Heijo was finally chosen.

In selecting the site many factors were considered and investigated thoroughly, among which might be mentioned: Local labor conditions; roads, electric lines, and railroad passenger service; freight transportation both in and out by rail and water; railroad siding; electric power supplies; coal and other fuel supplies; sewage facilities; water supplies; desirable land topography; and good solid soil upon which to build.

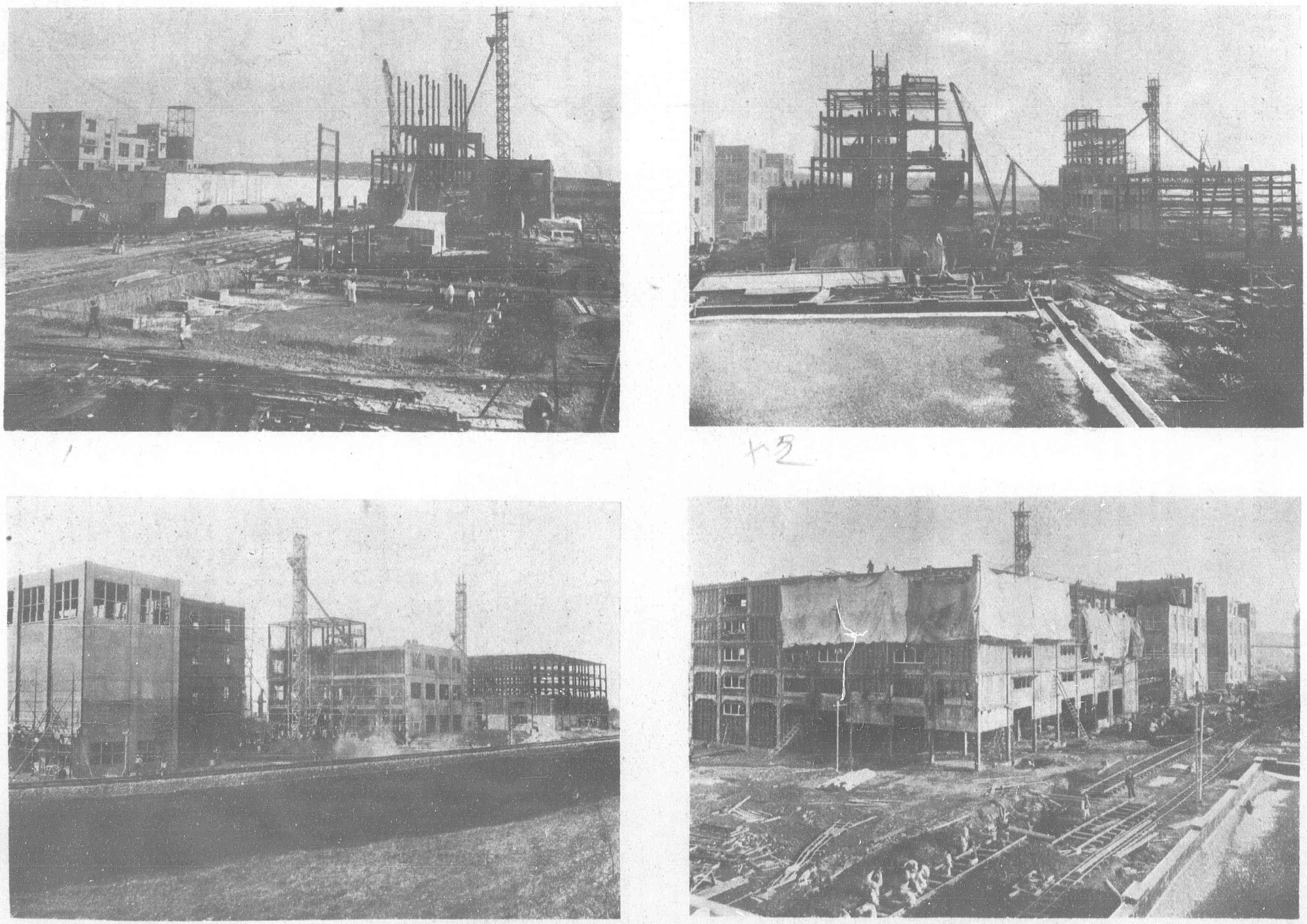
Heijo is the county-seat of a large farming district, having a population of approximately 120,000 people. It is situated on level low ground 35 miles inland on both sides of the Daido River, and at the foot of a mountain range which follows the course of the river. On high grounds directly above the city stands the celebrated Botan-dai, or Peony Heights, with its gate commemorating one of the hard-fought battles of the Sino-Japanese war. The city is located approximately 165 miles north of Keijo, the largest and most important city in Korea, and approximately 100 miles southeast from Shingishu, the border city between Manchuria and Korea. It is an important junction point on the main line of the Chosen Government Railway which connects with the South Manchuria, Chinese Eastern and Trans-Siberian Railway Systems, thus becoming a part of the transportation system from Japan to all Oriental and European countries. Thirty-five miles west from Heijo, on the China Sea at the mouth of the Daido River, lies the town of Chinnampo with harbor facilities and frequent services by several steamship lines. Efficient rail and water transportation is available between these two points.

The climate in this section of Korea is exceptionally good, every year having an average of nearly 200 pleasant days. The average yearly rainfall is 37 inches, and the concentrated rainfall period known as the flood season comes during the latter part of July and August. Severe cold weather and freezing starts approximately the middle of December and continues until the first or middle of March. In average years snowfall is rather light. The river is ordinarily frozen over from three to four months.

The site selected in Heijo consists of a large level area of approximately 68 acres located directly at Daidoko, a suburb of Heijo. The site is bordered on the north by the Daido River, on the east by the Chosen Government Railway and Daidoko Station, and on the south and west by a creek flowing into the river further down. It is approximately two miles from the center of the city on the main highway leading to the south and in the center of a district which will later be developed as the industrial and manufacturing section of Heijo.

Architecture and Engineering

As a part of preliminary engineering work, climatological conditions were carefully studied particularly as related to floods and flood protection methods. Data was furnished by the Chosen Government Meteorological Observatory located in Heijo and from the files of the Chosen Government Railway. Floods in this district are frequent and severe due to the lack of vegetation on adjacent hills, and the rise of the water in the river during flood time is extremely rapid. The maximum rise on record is about 31 feet. This investigation led to the construction of an earth dyke to protect the property.



The Nippon Corn Products' Plant at Heijo, Korea, under Construction

Chosen has been comparatively free from earthquakes for 300 years or more. At earlier dates they were apparently frequent and severe. Writers on the subject think that the country is now in a state of quiet. The Chosen Government Observatory at Jinsen, near Keijo, furnished all available seismic records, and a study of these indicated that at the present time there is little likelihood of destructive earthquakes. The consensus of opinion of people living there is that there will be no large earthquakes, and practically all building work is done without considering their possibility. There are, however, occasional earthquakes of small intensity, and these occur more or less regularly year by year. Taking into account all information available on this subject it was decided to design all buildings to resist earthquake action, thereby providing an extra factor of safety for the plant investment and the lives of those working in the plant.

Twenty-six core borings were taken distributed over the whole site to determine foundation conditions below the ground. An extremely hard gravel bed was found at a maximum depth of 42 feet below the surface. In other locations this hard gravel stratum was found very close to the surface by digging test pits, and in one location it was an outcrop at the ground surface. This gravel stratum was found to be excellent for building foundations, and soil bearing tests showed all overlying material to be suitable. A contour map was made of the surface of this gravel stratum and foundations designed accordingly. Fortunately the buildings could be located on the site so that spread footings or mat foundations could rest directly on the gravel near the surface and without piling.

In making core borings the ground water level during the months of October and November was found at an average elevation of about 20 feet below the surface. To determine available ground water supply, a four feet diameter well was dug and tests made on quantities available. Samples drawn from this well were tested and found to be suitable for drinking purposes and suitable for factory use. This same well was again tested the following summer and found satisfactory at this season. Design of the plant water supply was based on data obtained.

For all buildings complete architectural and engineering drawings, together with specifications, were made by Corn Products Refining Company Engineering Section in Chicago. The general architectural designs for the buildings follow the standards of design which have been developed in other plants built by this company. All buildings are very special and are designed from a utility standpoint, each building housing some particular operation, equipment, or apparatus. Many tanks, hoppers and bins are included, also thousands of openings, sleeves, etc. through walls and floors for piping.

The frame work of each building was designed to resist earthquake using a coefficient of 0.10 which is the minimum requirement stipulated in the Tokyo Building Code as revised following the great earthquake of 1923. Such design requirements for horizontal building motion are met by various types of bracing. X-bracing is used where possible, haunches are used on girders and beams, column sections are made larger and the radius of gyration about both axis nearly equal, and other provisions are made as individual cases require. Foundations are so constructed that the buildings, if acted upon by earthquake, will each move as a unit.

Material Used

In specifying the material for each building consideration was given to all factors affecting the particular unit of the plant. Particularly because of earthquake exposure, all buildings have steel frames complete with reinforced concrete floors and walls throughout. Some smaller units are made of reinforced concrete entirely. On many of the buildings a wood roof is used due to acid and moisture conditions within the building, and for the same reason wood sash is used throughout. As a special precaution all reinforcing steel is embedded in concrete more than the usual depth to resist acid action on concrete and rusting of steel due to exposure.

Construction

Preliminary construction work was started on the site in October, 1929. This work consisted of building an earth dyke about one mile long around three sides of the property, and completing the fill for the railroad siding to be laid from the main line into the plant. The railroad embankment forms a natural dyke along the fourth side of the plant. The dyke built averaged approximately 15 feet in height above the general property level. It was constructed by stripping the surface where fill was to be made. Earth was excavated and carried in *chigis* or shoulder baskets entirely by hand labor and deposited in place and tamped with large wooden mauls. Approximately 750 men were used in this operation and the entire dyke contained 110,000 yards of earth tamped, graded and levelled complete. The finished dyke has a six feet top-width and side slopes of two to one. The entire surface is sodded with *shiba* grass, sods being pinned in place with wood pegs. The top of the dyke is at an elevation one meter above the maximum recorded river flood stage.

Foundation tests and other preliminary work were done during the winter and were completed early in the spring. Actual construction work started in April, 1930, on the railroad siding and six buildings. From that time on work has been carried forward at full speed adding additional buildings as plans were completed, until at the present time all buildings and structures are complete.

The plant used for construction was quite similar to ordinary construction plants used on similar jobs of steel and reinforced concrete elsewhere. There were, of course, some variations because of local conditions. No extra plant or equipment was provided for speed because the progress schedule could not be determined at that time. The plant was made flexible for the various types of buildings to be erected. Methods of construction were similarly the usual methods for this type of construction, but these same methods were quite unusual to the town of Heijo and the people in that section of Korea.

The railroad siding was first completed moving materials by narrow gauge track. Most of the materials were delivered by rail. Sand, gravel, reinforcing steel and rails were delivered by lighter, forms were built beside the track towards the south end of the property and distributed by hand-cars on the siding. All reinforcing steel was cut and bent on the site. Structural steel was unloaded and distributed with caterpillar crane and erected with two travelling stiff-leg derricks. In general this job was executed with considerably less machinery and considerably more man power than usual construction operations.

The Heijo building material market is very limited, as are all markets in Korea. Material as available was purchased locally. The main items of equipment and construction materials were purchased in Japan and shipped to the job *via* Chinnampo and delivered from there by railroad or lighter. About 1,000 tons intermediate grade reinforcing steel were used. This is one of the few jobs in the Orient where this grade of steel has been used, and all of it had to be made by special rolling. Form lumber was furnished from the Yalu River forests about 100 miles from the job and machined at Shingishu where planers were especially installed for this order. About 3,000 tons of structural steel were used manufactured by the Imperial Steel Works in Japan and fabricated by Tokyo Bridge Company. Approximately 27,000 cubic yards of sand and gravel were dug by hand-labor from the river. Nearly all material of local delivery was brought to the job site by bull-carts.

Labor throughout the job varied from a few men during the preliminary work to a maximum of about 1,200 men at the height of the job, this number gradually reducing towards the end. The majority of workmen used were Koreans native to the Heijo section or from some other outlying district. Some few Chinese were employed at times during the work. The balance of men, including the most skilled workmen, were Japanese. Sub-foremen and foremen were developed from the workers during the job. The foremen supervising the work were from the Builders' Organization in Tokyo.

From November 1, 1930 on, winter conditions predominated at the site more severe than the usual winter, and it was thought at one time that the job would have to be closed down until warmer weather. It was found, however, by rescheduling some operations and taking advantage of all breaks in the weather that work could be continued through with a partially reduced force, and little time was lost due to the cold weather. Concrete was placed in various buildings, steel erection continued on those buildings then being put up, and carpentry both inside and out and the other miscellaneous items comstituted the balance of the winter work.

Construction methods and details used throughout this work were quite well-known to the foremen and skilled workmen taken to the site. To the balance of the men these were quite unknown and a great deal of time was spent in teaching the men as a whole to work in accordance with the prearranged plan for this operation. It was found, however, that they were ready and anxious to learn new methods and that they grasped them rather quickly. When the job got over the initial stages and into full swing the workmen proved to be quite equal to the various tasks assigned to them, and all divisions went forward with excellent results and a fair rate of speed. The progress of the whole job kept pace at all times with the schedule of individual building operations and the plans as a whole. All field engineering, tests, investigations, and construction work were handled by the Tokyo branch office of The H. K. Ferguson Company.

Machinery and Equipment

The boiler house and engine room will furnish the power and steam for operating the plants. They will be equipped complete with the most modern power plant machinery. Power will be furnished by two 500 h.p. Babcock & Wilcox boilers having powdered fuel equipment and with separate coal drier. These will operate at 400 lb. pressure and with 1,000 superheat. There will be one 1,500 kw. turbo-generator set, bleeder type, operating at 440 v., 60 cycles, 3 phase.

Each of the other buildings throughout the plant will be equipped with special machinery for the various operations handled in that particular building. Shops have been installed in building 65 for the maintenance of electrical, mechanical piping and wood work. A plant laboratory has also been established in this building.

The water supply for the plant will be obtained from ten 65 feet deep wells which are now being drilled at the north end of the property. From these wells it will be pumped to Building 13 and distributed from there. Building 13 will house two 5,000 gallon pumps for sewage and one 1,000 gallon Fire Underwriters' centrifugal pump for fire protection. The fire protection system will consist of underground lines and hydrants.

Piping throughout the plant is a very large item. As soon as the buildings were fairly well started, the owner started installing pipes and this work is following the progress of the job. Electrical work and mechanical trades are also being installed in the same manner.

More than one-third of all equipment housed in the plant was purchased locally, most of the special machinery was purchased in America and Europe and shipped to the site. Four vacuum driers shipped from Warren, Penn., weighing 35 tons each, were the largest load ever handled at the port of Chinnampo and caused considerable difficulties due to lack of adequate handling equipment.

The New Company

Nippon Corn Products Kabushiki Kaisha operating this new plant will be a separate company financed with an authorized capital of Y.10,000,000 which will be held by the home company in New York and which will be participated in by local interests.

The company's main sales office is located at Osaka and a branch office is located at Tokyo. The executive control of the entire company is directed from Osaka. The officers of the company are : Managing Director, R. S. K. Irvin ; Treasurer, Thomas Griffiths ; Auditor, J. W. Scott ; Sales Manager, E. J. Guetta ; Director, J. R. Geary, (General Electric, Tokyo) ; Director, J. C. Goold, (Gen. Mgr. Standard Oil, Tokyo); Assistant to Managing Director, T. von Ellbrecht. Arrangements have been completed whereby the Mitsubishi Goshi Kaisha will acquire a share of the capital. The Mitsubishi Shoji Kaisha handle the sales of corn syrup and corn sugar. Brunner, Mond & Co. are representatives in connection with the sale of starch and dextrine. Sales of cattle food, crude oil and grocery lines are handled direct by the Nippon Corn Products Company, these products being distributed direct through representative dealers in each locality.

The advent of this plant into Korea is fortunate in that it introduces new raw materials not being produced in this section now. It will, therefore, not crowd present industries. It gives Japan new products to work with and provides a new industry in Korea which will give employment directly and indirectly to many people.

Manufacturing supplies will be drawn largely from Manchuria in the winter and from Java in the summer. There is not much local corn available because land is not available in Korea for economic production. Coal will be supplied from local mines near the plant or possibly from Manchuria. The plant will be equipped to operate on either corn or *kao-liang* (milo or kafir corn.)

A new development in manufacturing peculiar to this plant will be that corn will be flushed from Building 42 to 16 feet diameter 26 feet high wood stave steep tanks in Building 3, and from these tanks to the mill Building 5 where starch will be separated from the chaff and germ. The germ will be dried in steam driers in Building 17 and the oil extracted by expellers. Chaff will also be dried in Building 17 and packed as cattle food

Starch liquors will be tabled in Building 9, refined and gluten removed. Clear starch will be washed in Building 29 and dried in vacuum driers, a portion will be pumped to Building 53 in a liquid state for conversion to glucose.

The new plant will manufacture the following principal products : Strach in various forms, industrial corn sugar, corn syrup, edible oils, and cattle food, which products will be consumed largely by the following industries : Textile, artificial silk, paper manufacturing, tanning, and confectionery. Starch will be marketed in packages and in bulk.

This plant will have six men from other plants as a nucleus to start, and the balance of the personnel will be made up from local sources. The company is now building five houses for their staff on elevated ground overlooking the Daido River near the new plant, and they have plans for baseball, tennis, and other athletic facilities for employees to be developed on land within the manufacturing compound at a later date.

The new plant represents the most modern plant layout and construction. It embodies all improvements in machinery and equipment for efficient corn refining. It is the second largest plant of its kind outside the United States, one larger being operated by the same company in Germany.

Japanese Harbors Improvements

A plan to improve 50 Japanese ports and harbors by means of bonds issued for unemployment relief, at a cost of Y.22,000,000, of which one half is to be shared by the National Treasury and the other half by the local communities where the ports and harbors are located, has been drafted by the Tokyo Home Office. Upon the final approval of that office being given to the draft plan, negotiations are shortly to be had with the Finance Office to secure its approval.

The foregoing plan is in addition to the road plan for which it is proposed that the Imperial Government shall furnish Y20,000,000 by means of bonds for unemployment relief, the local communities also sharing about Y20,000,000 raised by bonds. There is a further plan for controlling about 50 large and small streams, costing Y30,000,000 of which one half is to be furnished by the National Treasury, to be completed in three years.

Out of 50 ports and harbors which it is proposed to improve, 10 will cost about Y1,000,000 each, as follows (prefectures bracketed)

Misumi (Kumamoto), Oita (Oita), Sakata (Yamagata), Hososhima (Miyazaki), Hiroshima (Hiroshima), Shikama (Hyogo), Kishiwada (Osaka), Uo (Okayama), Tokushima (Tokushima), and Nishinomiya (Hyogo).

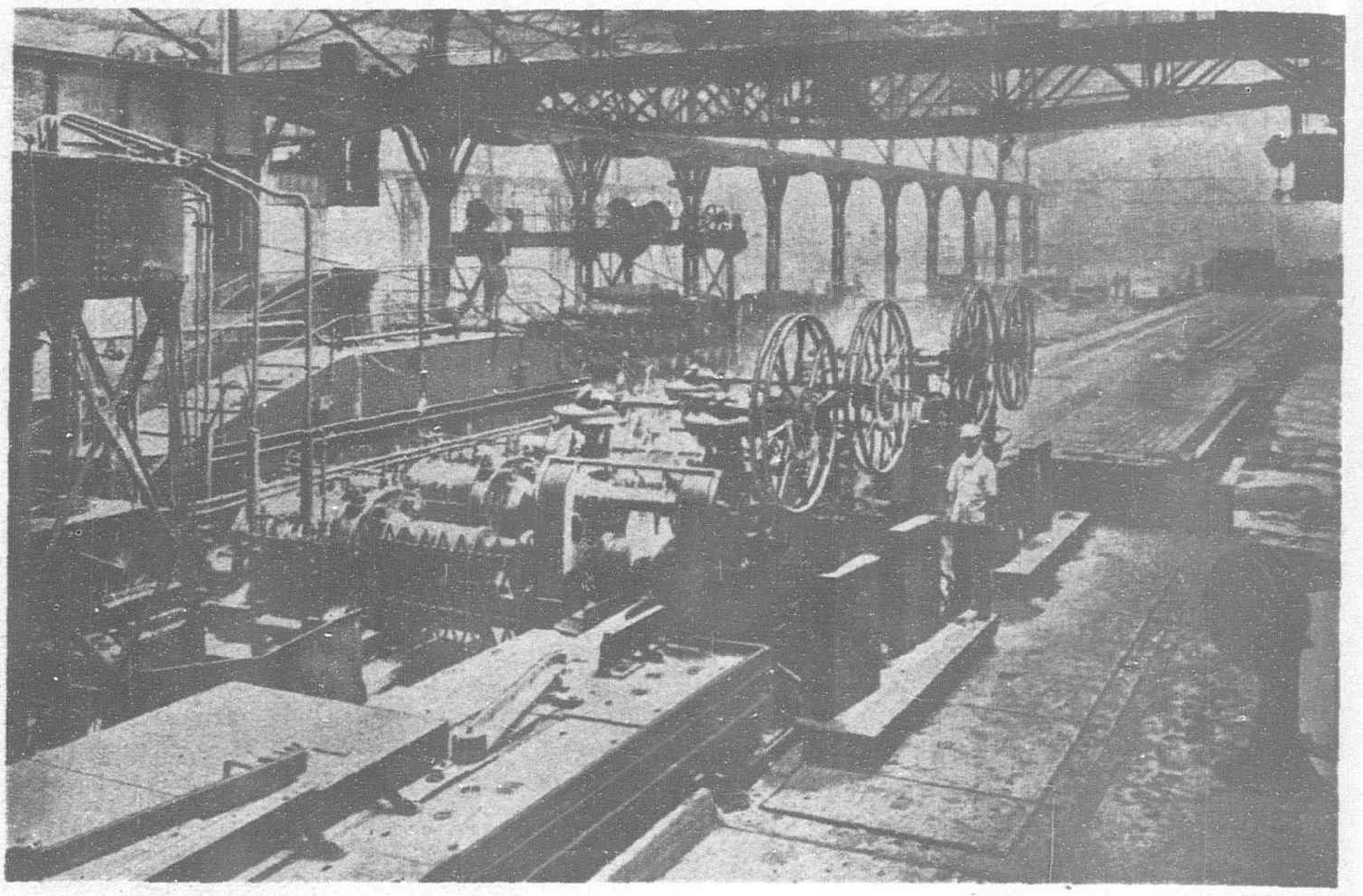
The ports and harbors whose improvement will cost between Y300,000 and Y500,000 are to be distributed in different prefectures at the rate of one or two each, limiting the total number to 40. Of these 40, those already picked by the Home Office are as follows :

Miyazu and Shin-Maizuru (Kyoto), Akashi (Hyogo), Mogi (Nagasaki), Ebisu and Teradomari (Niigata), Nakaminato (Ibaraki), Matsusaka (Mie), Taketoyo and Handa (Aichi), Shimoda (Shizuoka), Ishimaki (Miyagi), Kamaishi (Iwate), Kamo (Yamagata), Itozaki (Hiroshima), Wakayama, (Wakayama), Uwajima and Mitsugahama (Ehime), Unoshima (Fukuoka), and Karatsu (Saga).

Others are in the course of selection. In view of the fact that in issuing bonds for unemployment relief, intending to improve ports and harbors, as well as rivers, it is necessary to establish a new law for bond issues, doubts are entertained as to whether Finance Minister Inoue will consent to such bond issues.

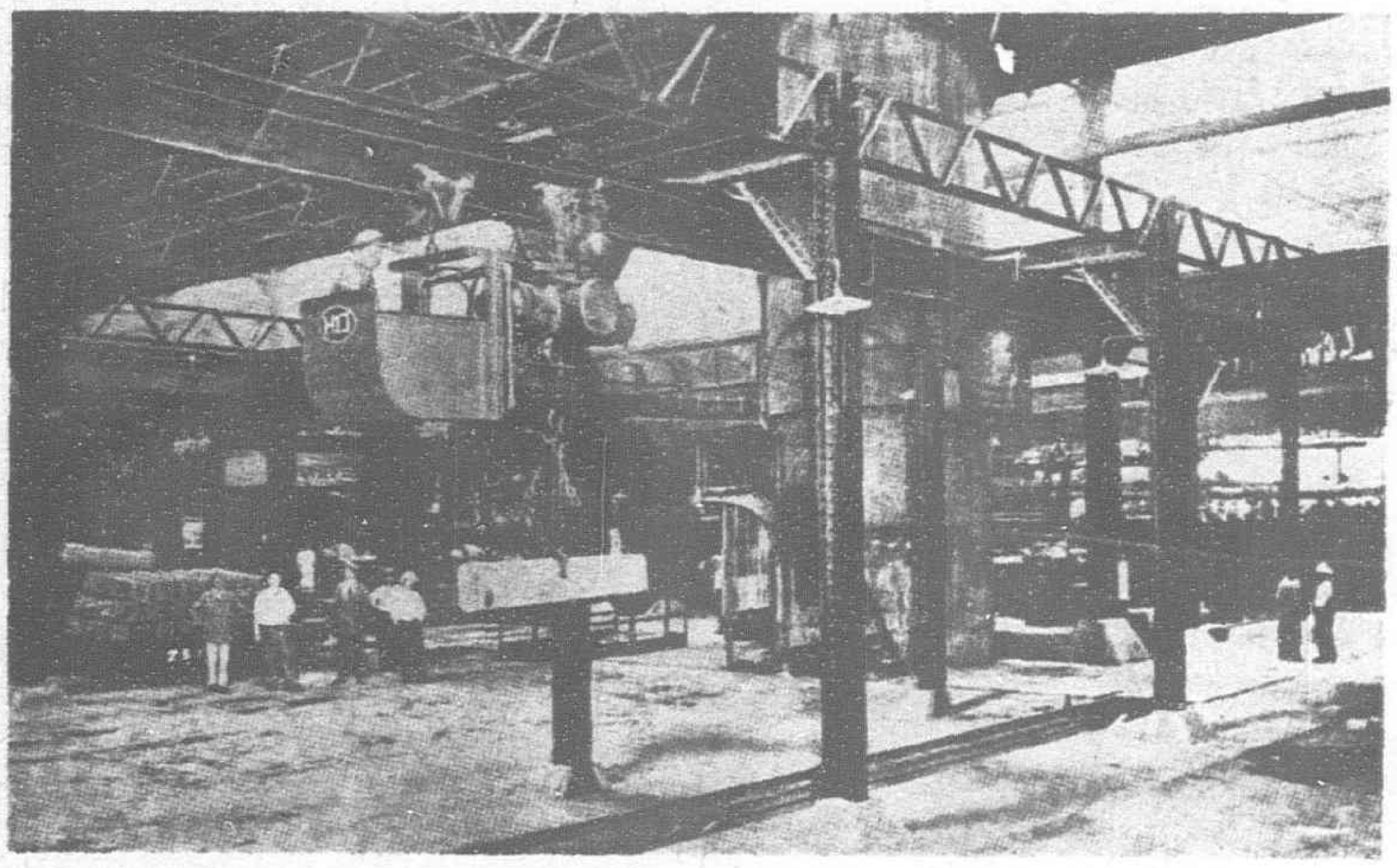
German Mill Installed in Japan for Semi-Continuous Sheet Production

About a year ago the Friedrich Krupp A. G., Essen, Germany, installed a semi-continuous mill for rolling sheet bars and sheets in the Kawasaki Dockyard Co., Kobe, the largest sheet producer in Japan. As the Japanese were not familiar with such a mill and its operation, it was estimated by the maker that it would have an initial capacity of about 600 tons a day in full operation, but in less than 10 weeks after installation, daily output reached 700 to 800 tons of sheet bars 200 by 6 mm. (8 by $\frac{1}{4}$ in.), and recently production has been 800 to 1,000 tons daily, which is more than the rated capacity of the mill.



Sheet bar rolling mill installed by Krupp Grusonwerk, Magdeburg, Engineers

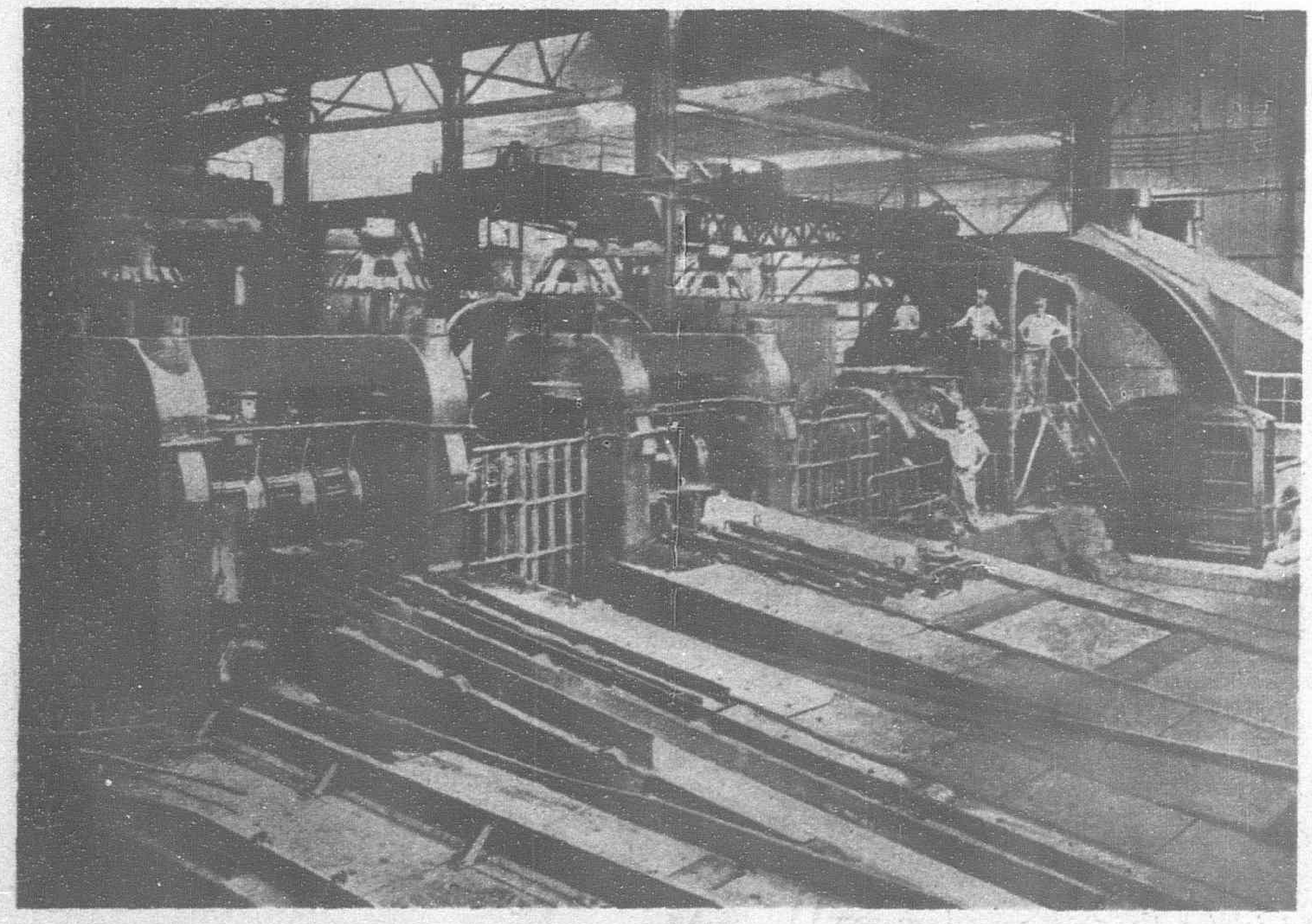
The installation consists of a two-stand, three-high blooming mill with rolls 750 mm. (29.52 in.) in diameter, and a four-stand, continuous finishing mill with rolls 460 mm. (18.11 in.) in diameter. From the furnaces, the ingots are transported by electric monorail crane to ingot pushers, four of which have a total capacity of 35 tons. After passing through the first mill, the 1-ton blooms are sheared in half and move into the second mill, where, following reduction to sheet bars, shears with a cutting length of 750 mm. (29.52 in.) permit cutting three bars at once. The sheet bars then drop to a conveyor and are automatically moved to the sheet mill. In 19 passes an ingot 320 mm. (12.57 in.) square is reduced to a sheet bar, 200 by 6 mm. (8 by 1/4 in.).



Transferring 12½-in. ingots from the furnace to the ingot pusher for first reduction in the blooming mill

The few Japanese workmen trained in Germany prior to installation of the semi-continuous equipment in Japan showed unusual ability. The present mill has been so satisfactory in its operation that a similar installation is to be made by the Anzin Steel Co. in Manchuria, operated by the South Manchuria Railway Co.

The term "sheet bars" means an iron plate about 120 mm. to 300 mm. in width and from 6 mm. to 25 mm. thick, which forms the starting material for making fine sheets.



Housings for preliminary rolling three rolls each of 750 mm. diameter acting as cogging mill

For the purpose of preliminary rolling, the rolling mill comprises two housings with three rolls each of 750 mm. diameter acting as cogging mill—see lower illustration—and for finishing, four continuous housings—that is, arranged one behind the other—with two rolls each of 450 mm. diameter—see upper illustration. This mill train rolls sheet bars 200 mm. wide and from 6 mm. to 8 mm. thick. The starting material consists of ingots about 300 mm. square, weighing 1,000 kilos. In order to obtain the finished bars, each ingot has to pass about twenty times between the rolls. The bars issuing from the finishing rolls have a length of about 45 m. These bars are first deposited on a cooling bed, where they remain some time for cooling purposes. Then three bars are placed together on a roller conveyor and taken to the cold shears, where they are cut to the length required for the thin sheet rolling mills.

The roughing mill is driven by a motor of about 1,800 h.p. which has a fly-wheel weighing about 60 tons and which drives the mill direct. The finishing mill is driven by a 2,400 h.p. motor through gearing.

The capacity of this rolling mill is about 700 tons of sheet bars, of the above-mentioned dimensions, per day of 24 hours.

Vegetable Fibre Cultivation in the Tropics

IN addition to rubber, the most widely known exports of tropical countries are sugar, coffee, cocoa, tea, tobacco, herbs, nuts, etc. Another very important export is vegetable fibre for the manufacture of hemp ropes and woven fabrics. Thus nearly 60,000 tons of vegetable fibre, representing a value of about 35 million marks (£1,750,000), were exported from the Dutch East Indies during the year 1929.

Fig. 1 shows a plantation growing the agave plant, the leaves of which yield the fibre. This plant was originally a native of America but during the last century has been cultivated in various parts of the world.

When the plant is two years old, its leaves are cut at regular intervals, while leaves grow afresh in the middle of the plant at the top of the trunk until a mass of blossom, attaining a height of several metres, is formed. It withers shortly afterwards. New plants are grown from the seeds or the off-shoots. The plant requires but little nursing, and in the tropics continually yields new leaves until it perishes, so that the preparation factories can be operated without interruption.

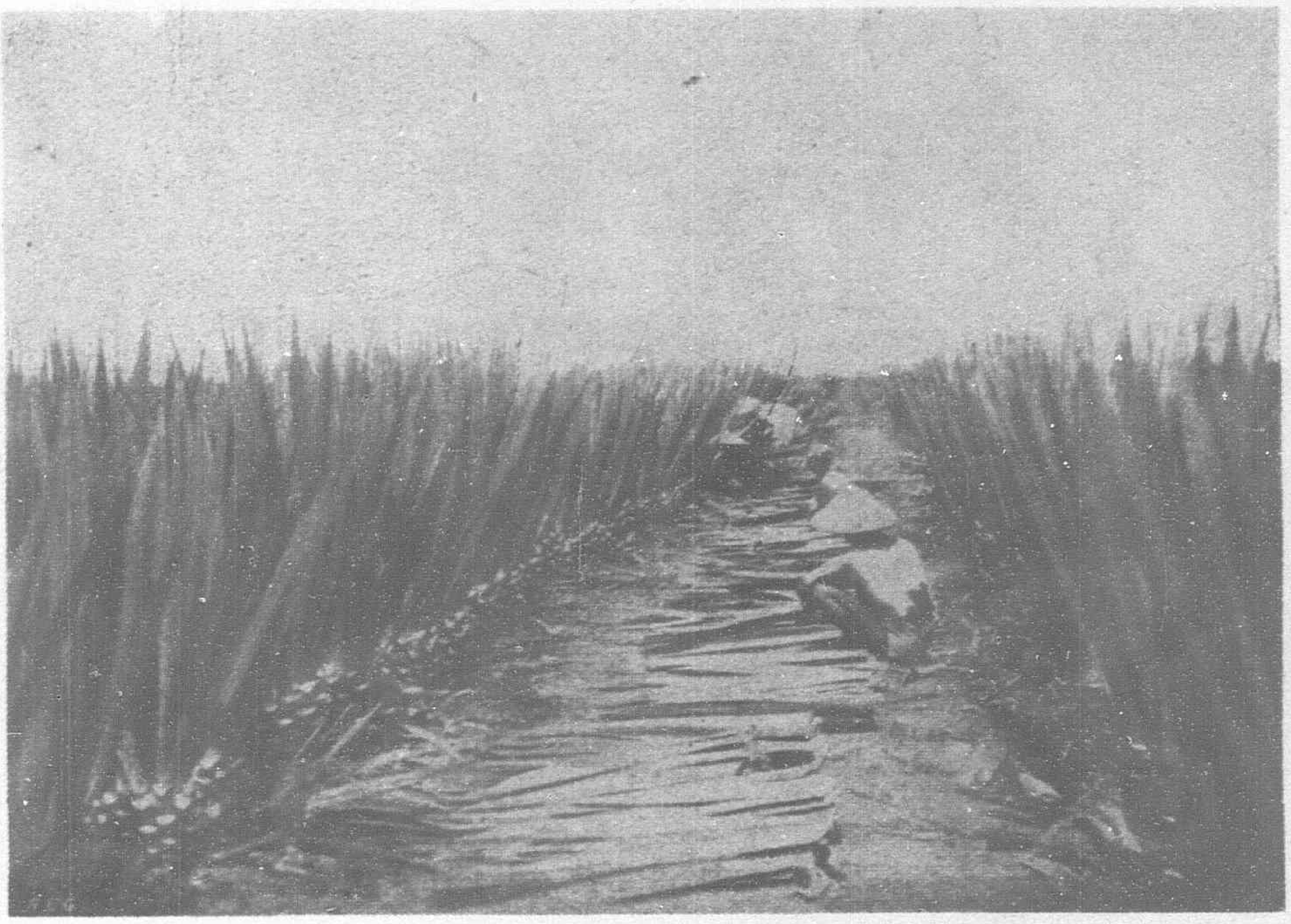


Fig. 1.—Agave Plantation

Small plantations are not always remunerative, on account of the high freight rates to the consuming countries and the widely fluctuating market prices. In the Dutch East Indies therefore, the plant is cultivated in extensive plantations, financed by European capital, and equipped with factories operating on a highly economic basis to yield competitive prices.

It may be mentioned in this connection that the factory shown in Fig. 2 possesses a plantation of 6,000 ha=60 sq. km (15,000 acres=23.5 sq. miles) in area growing agave only.

In addition to power for extracting the fibre from the leaves, heat is also required for drying. Drying can also be effected in the sun. In such case, however, one is dependent upon contingencies, especially during the monsoon period, quite apart from the difficulty of keeping a sufficient number of people available for conveying the fibre to and from the drying fields. The ultimate effect will be that vegetable fibre which is dried in steam-heated ovens has a better appearance and more uniform quality, hence this method is being adapted on an increasing scale; additionally, manufacturing proceeds without interruption. Under these circumstances, moreover, the residue is utilized for heating purposes, just as the native sugar factories fire their boilers with the bagasse from the sugar cane.

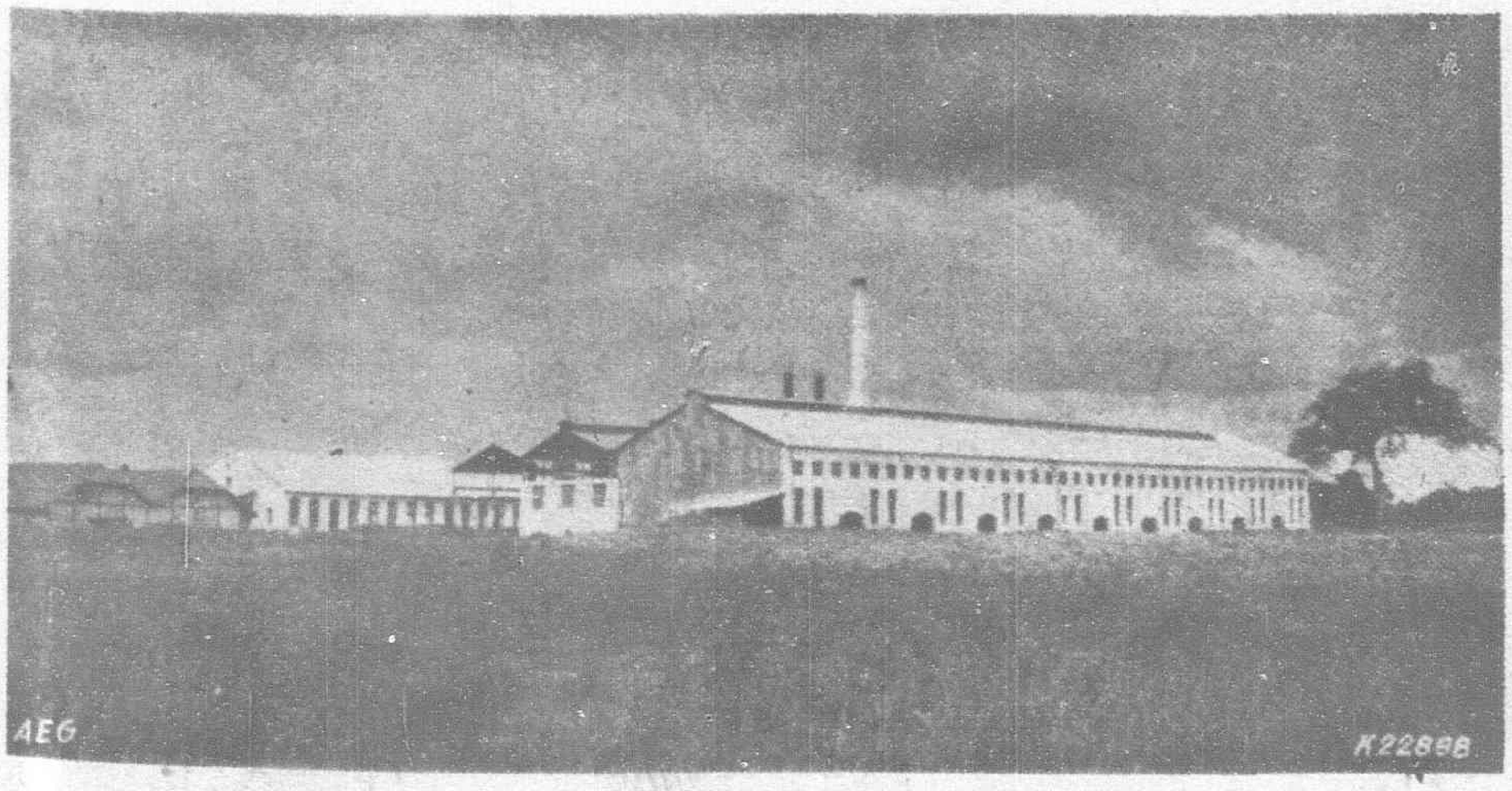


Fig. 2.—Factory for Extracting the Vegetable Fibre

Investigations instituted in Java established that when dry, the residue of the leaves (bagasse) has a calorific value of 4,300 kcal per kg (7,800 B.T.U. per lb.), which is approximately equivalent to that of the bagasse obtaining in sugar cane factories.

In the Dutch East Indies, the experience accumulated in the sugar industry has been applied to the drying of the bagasse from vegetable fibre. The residue from the extraction machines is passed through troughs to a mill system (Fig. 3), which presses the water out of the bagasse by means of two mills arranged in tandem, similar to the method known in the sugar industry. Following this operation, the residue, now possessing but little moisture, is delivered automatically to the boiler plant by way of chain conveyers (Fig. 3). The economy of the entire plant is not alone greatly enhanced from a heat-technical standpoint owing to the use of bagasse for heating purposes.

The residues of combustion also contain appreciable amounts of potassium and are of immense value for fertilizing purposes. Thus such residues are highly important for promoting the cultivation of the plants from which they derive.

Moreover, burning of the bagasse eliminates a vexatious problem. Many establishments are perplexed as to where to dump the bagasse and especially the withered stalks, and therefore the usual course taken is to bury them. Compared with this, the burning of these residues for steam-raising purposes is in numerous respects a great improvement.

With regard to the high economic standard attained in the Dutch East Indies, mention is made, for comparative purposes, of a publication, which, based on experience gained in other countries, does not commend the transportation of the residue to the factory but favors the extraction of the fibre out on the plantation—remote from the factory—so as to abandon the transport of the residue with the leaves.

Fig. 3 shows the mill plant from the rear with ironclad switchcases for the driving motors. As the stalks have a great moisture content, they are, at present, also rolled dry in the mills. A portion of the stalks is delivered to the boilers manually.

The Garbe-water tube boiler plant supplied by Messrs. Sulzer, with economizer and super-heater has a boiler heating surface of 500 sq. metres (about 5,360 sq. ft.).

As stated above, heating steam is required for drying the fiber. In concordance with the experience of the sugar industry back-pressure and extraction turbines proffer the greater advantage

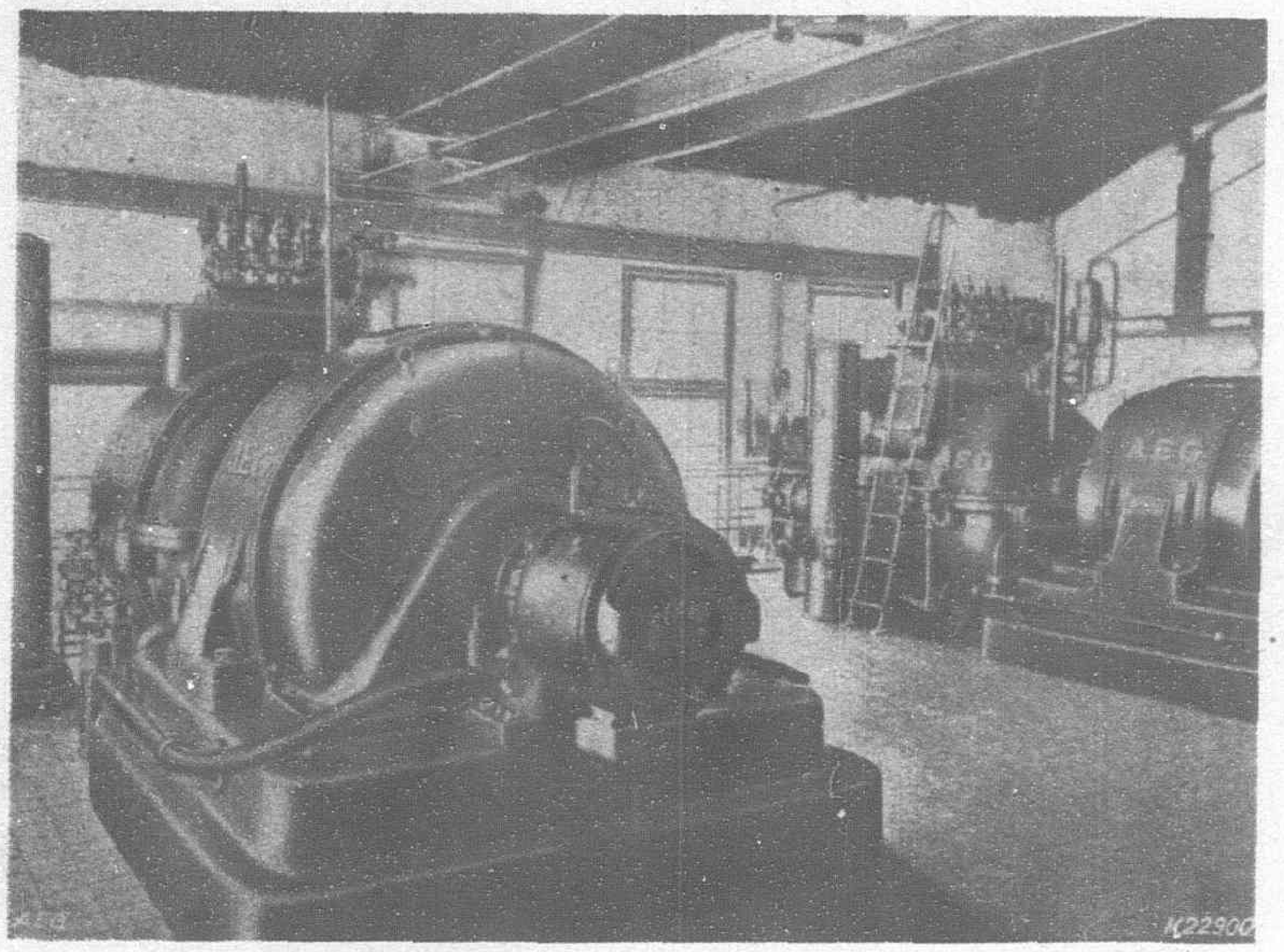


Fig. 4.—On the Right: Extraction Turbine with 450 kw. Alternator for Live Steam Pressure of 100 lb. per sq. in Gauge and 40 lb. per sq. in. Abs. Extraction Pressure. On the Left: Condensation Turbine with 650 kw. Alternator

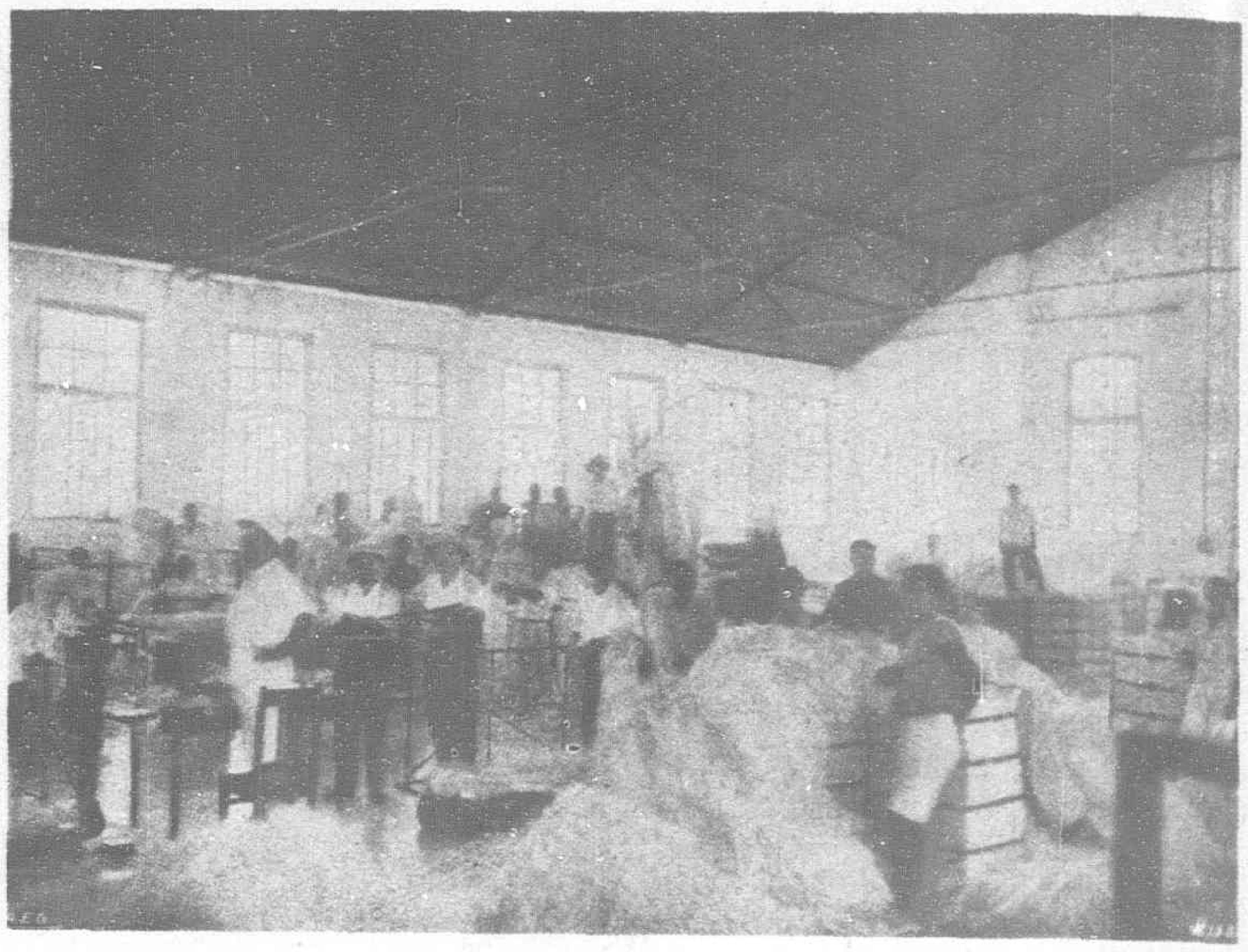


Fig. 6.—Assorting Room

under such circumstances, for besides the steam extracted for heating purposes, the turbine will still develop sufficient energy for supplying the motors in the factory without entailing noticeable extra cost in fuel. In well-equipped factories, the steam consumption for heating purposes amounts to about 1.5 kg per kg of fibre so that it is much smaller than the quantity of steam requisite for producing power.

For the plant under consideration, the AEG initially supplied an extraction turbine—as being the most appropriate for the pertaining conditions—with a 450 kw. generator and having a maximum steam extraction of 5,000 kg per hr. at a live steam pressure of 7 atm. gauge (100 lb. per sq. in. gauge) and 3 atm. abs. (40 lb. per sq. in.) extraction pressure (Fig. 4, on the right).

The favorable results attained with this turbine secured for the AEG a subsequent order for a set whose turbine works as a pure condensation machine (Fig. 4, on the left). The extraction turbine first supplied, is capable of providing sufficient steam for heating purposes, and in virtue of its great reliability it was unnecessary to procure a second unit. The condensation turbine supplies energy to neighboring tea and tobacco factories more particularly so during the dry season when the energy available from the hydro power plants is inadequate for these factories. The output of the condensation turbine amounts to 650 kw.

The alternators for 380 volts three-phase 50 cycles are devised with a neutral for the lighting plant, which is fed at 220 volts alternating current.

The cooling water of the condensers is re-cooled by means of a jet-nozzle plant. As strong winds seldom occur in the tropics, the loss in cooling water through being scattered is practically negligible, hence it was not essential to erect louvre structures round the cooling pond. Apart from the costs, the cooling effect of the plant would be adversely influenced by such structures. The building at the back-ground of Fig. 5 is the tapioca factory whilst the pump house with elevated tank is situated on the right.

The leaves are conveyed to the extraction machinery through the openings visible in the front wall of the factory building. The fibre exploited with the assistance of these machines is cleaned and dried in centrifugals, and having passed through the steam-heated Schilde dryers is conveyed to the assorting room (Fig. 6). In other establishments, the fibre is, in addition, often brushed in special machines, but this practice was not necessary in the factory under consideration, for the appearance of the finished fibre is everything that could be desired owing to the manufacturing methods adopted. When assorting by hand, the fibre is freed from dust merely by striking it against wooden beams. It is thereupon pressed into bales by means of a hydraulic press and subsequently shipped. In addition to the turbo-sets with switchgear, the AEG supplied a large number of motors and equipment for the drive of the pumps and auxiliaries.

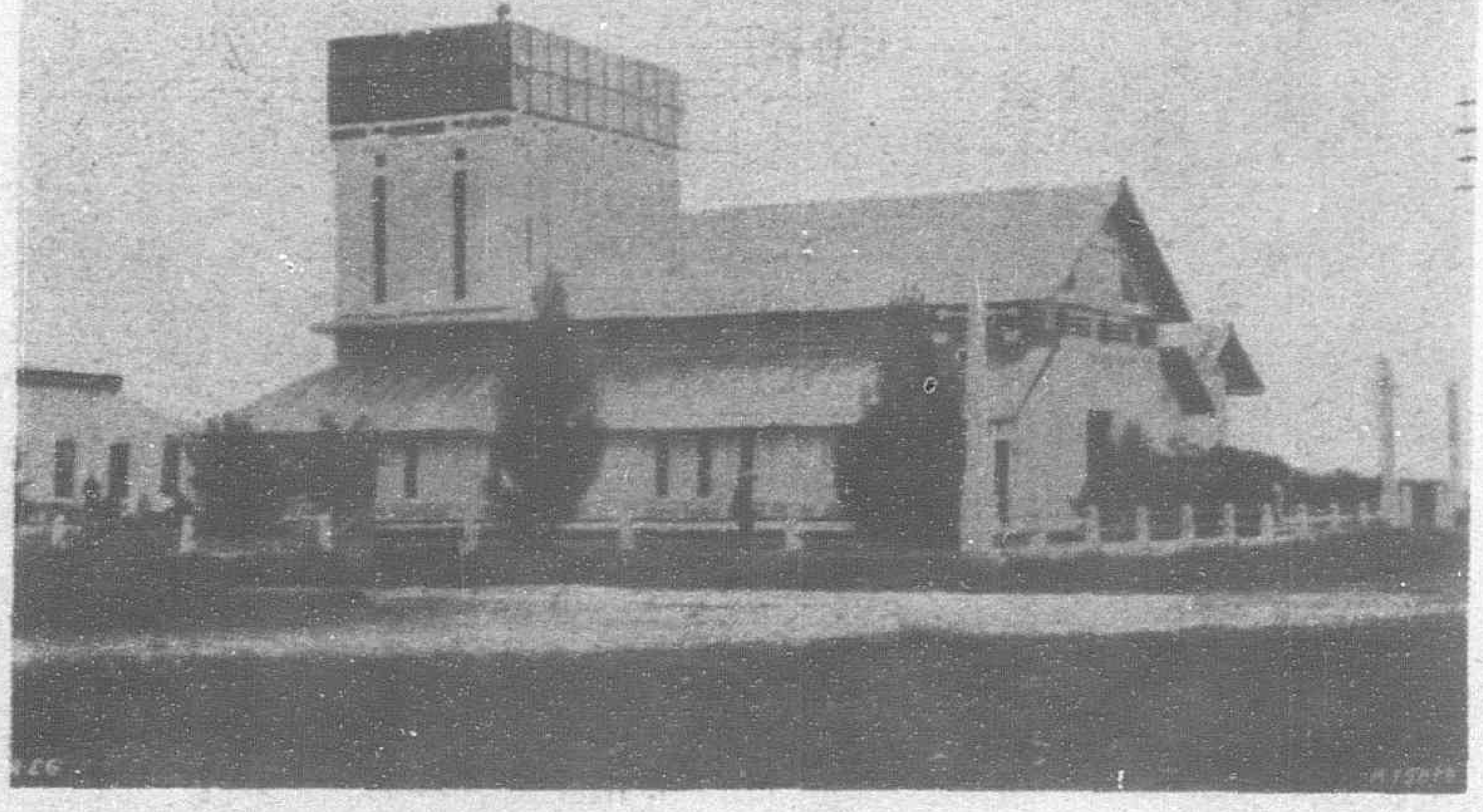


Fig. 5.—Pump House with Elevated Tank. In the Background: The Tapioca Factory

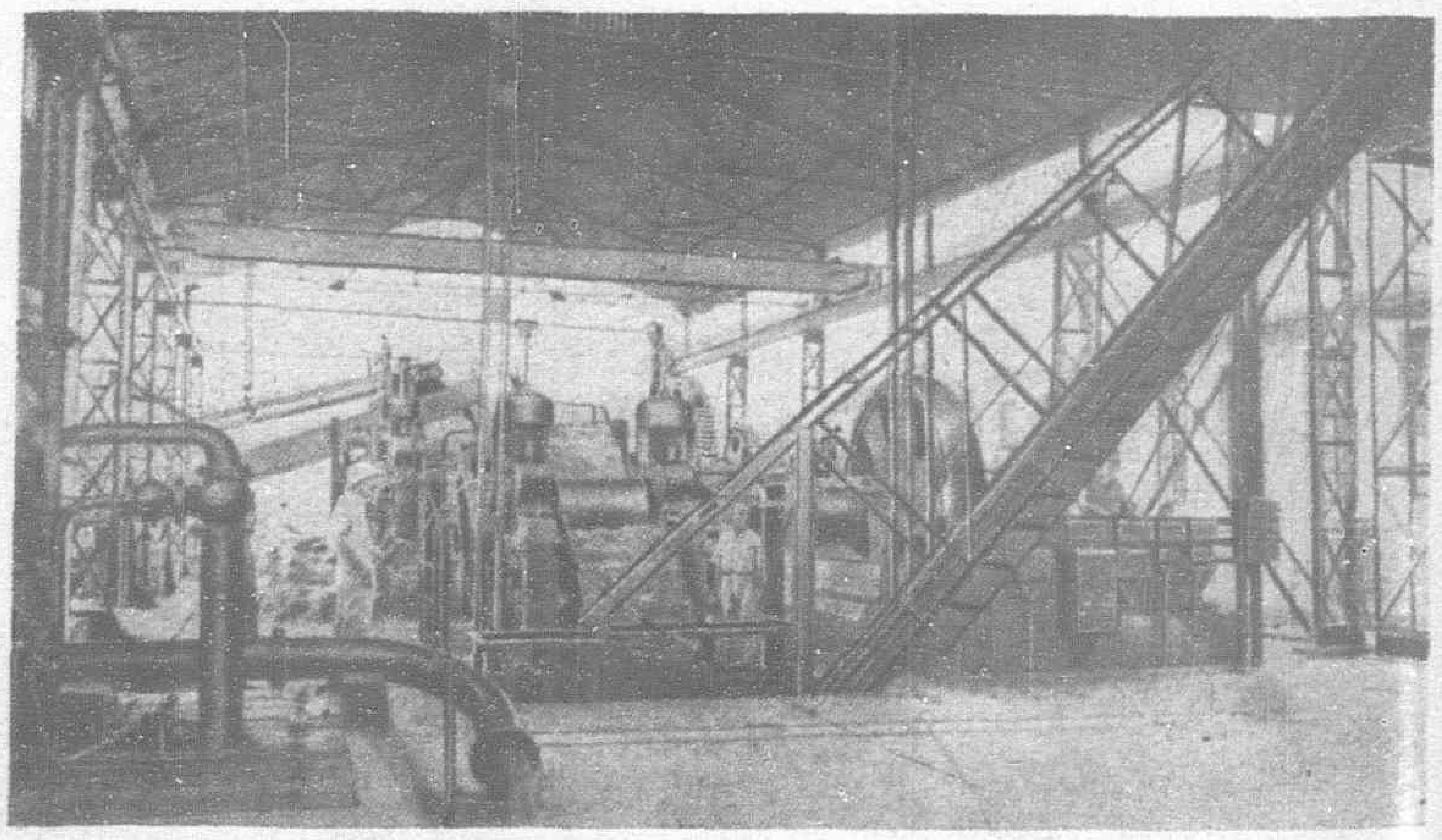


Fig. 3.—Mill for Extracting Water from the Fibre, and Chain Conveyor. On the Right: Ironclad Switchboard for the Mill Motors

Automatic Substations of the Ise Electric Railway, Japan

THE Ise Electric Railway is one of the rapidly developing private transportation systems in Japan.

When completed, its double track 3-ft. 6-in. gauge line will extend from Nagoya to Yamada, which are about 68 route miles apart.

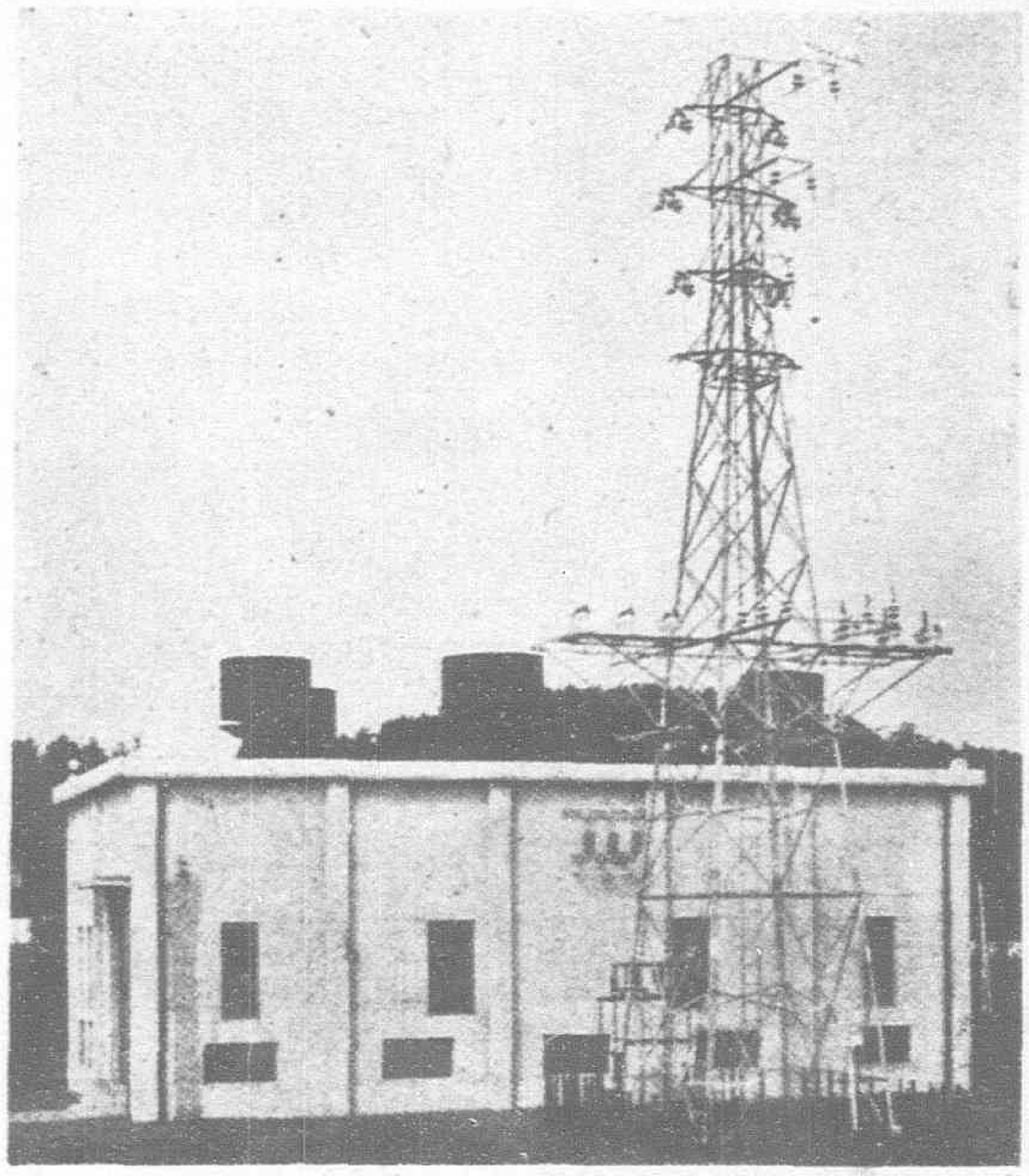


Fig. 1.—Heta Automatic Substation

Its construction was brought about by several factors. The Imperial Shrine at Ise, near the Yamada terminus of the line, attracts many thousands each year. This traffic is extremely important and necessitates an efficient service.

Cities such as Yokkaichi and Tsu, situated 23½ miles and 43 miles respectively from Nagoya, are large industrial centers principally engaged in cotton manufacture, and many employees live in the surrounding villages.

Additionally, the whole country served by the Ise Electric Railway is of great fertility, therefore the rapid transport of agricultural products is important.

Considerable progress has been made in the construction program, and in certain sections the railway engineers have had to overcome several difficult civil engineering problems. The object desired was a low overall cost of plant. The straightforward economical design of building shown in Fig. 1 was adopted to achieve this.

Owing to the high ambient temperatures—90 to 96 degrees Fahr.—experienced in a Japanese summer, ventilation of automatic substations must be carefully studied.

In the Heta substation, described later, this is provided for by screened apertures of adequate area near floor level, and roof ventilators.

The bottom ventilating openings are equipped with adjustable louvres, as winter conditions are moderately severe.

Power for the operation of the system is furnished by the Toho Power Company, and is transmitted by a three-phase overhead line working at 11,000 volts, 60 cycles. The complete electrical equipment for the three automatic substations was manufactured at Stafford, and the Heta substation, illustrated in Fig. 1 and described in detail in this article, has been in successful operation for about twelve months; the other two substations have precisely similar equipment.

Heta substation, which is about half-way between Nagoya city and Yamada, at present supplies some 21 miles of single and double track through three feeders. Two of these feeders supply the up and down track of an eleven-mile section from Tsu towards Matsuzaka, the third supplies the ten-mile single track section from Tsu to Hirako. The substation is situated close to the track, and high speed circuit-breakers are connected in the feeders. Section insulators and switches are situated at various points along the track.

Conversion of the A.C. power to a 1,500-volt D.C. traction supply is carried out in each substation by two pairs of series-connected rotary convertors having a total capacity of 4,000 kw. These machines are arranged for tap starting and are equipped with oil-lubricated roller bearings of the special English Electric design; each is fitted with a direct-coupled exciter, overspeed device, no-start device, and bearing thermostats. A transformer of the double-secondary type supplies each pair of convertors.

Control apparatus for complete automatic operation is grouped in a compact and orderly manner, and a special feature is a semi-circular desk from which the working of the equipment may be controlled by push button, if desired.

For the control of the incoming A. C. supply a sheet-steel truck-type board is provided, which contains:—

Oil-immersed switch-fuse for the 150 kva. auxiliary transformer bank.
400-ampere incoming feeder panel with motor-operated circuit-breaker.
Cubicle with potential transformers, isolating switch and metering equipment.

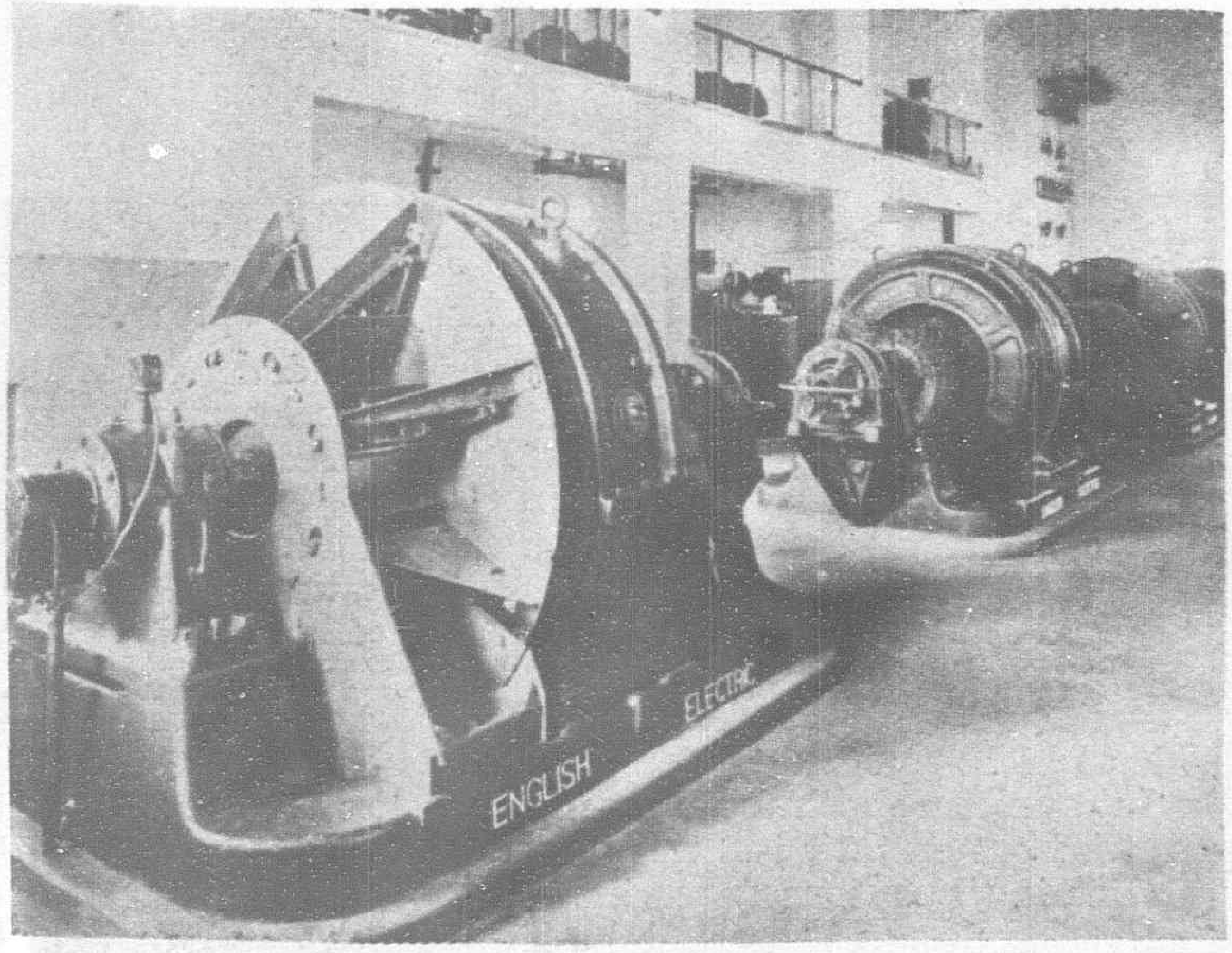


Fig. 2.—4,000 kw. Convertor Plant for 1,500-volt D.C. supply

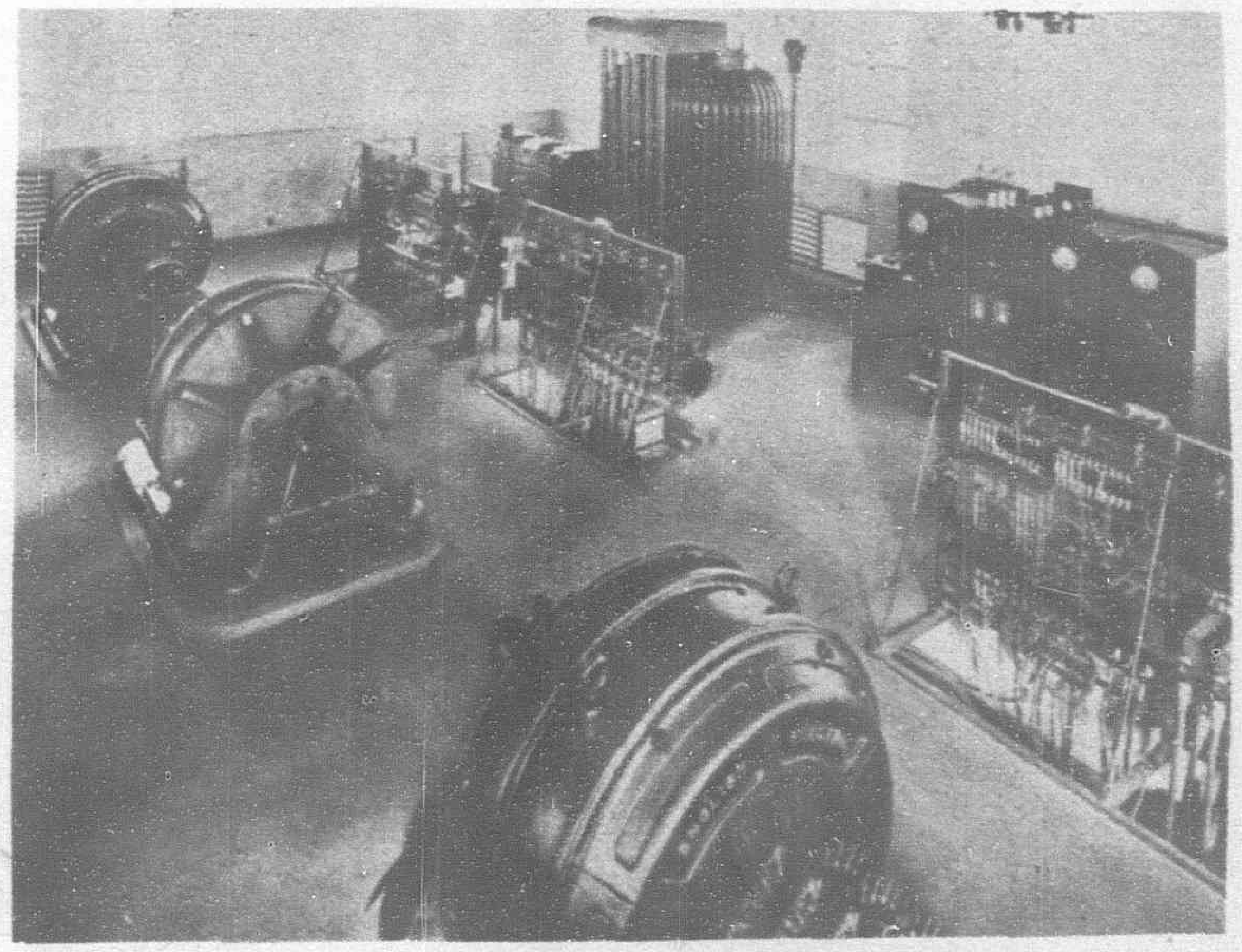


Fig. 3.—General view showing 11,000-volt Transformers and Switchboard

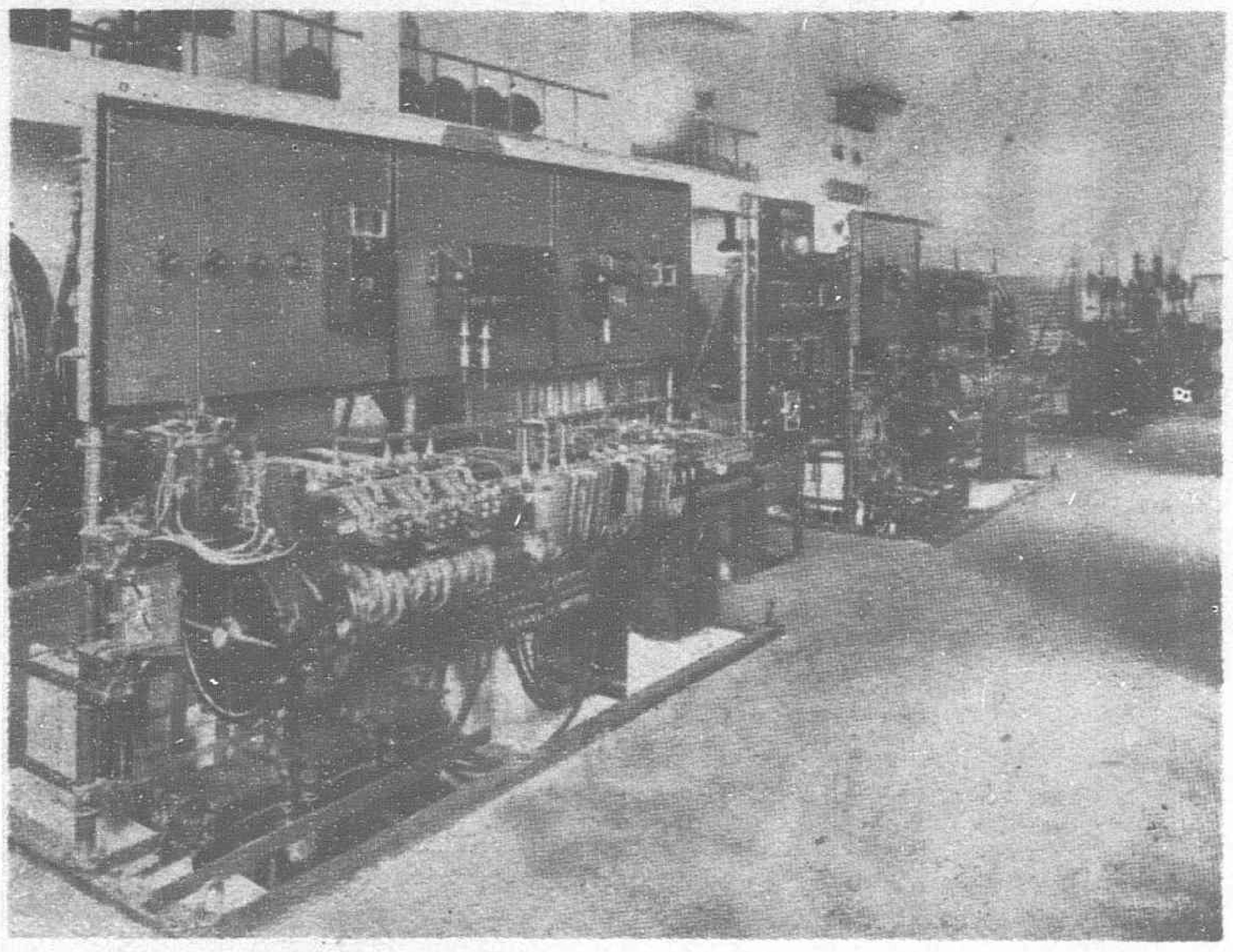


Fig. 4.—Camshaft Controllers and Common Relay Panels

Two main transformer panels each with 11,000-volt motor-operated circuit-breaker.

In Fig. 3 can be seen in the background the auxiliary and main transformer and the 11,000-volt truck board for one pair of convertors ; the units in the board are in the order given above.

The automatic equipment for each machine is grouped on a framework which carries the camshaft controller for starting and synchronizing, together with the various relays, and, in addition, there is a common relay panel to each pair, on which are the A.C. low-volt relay, starting sequence relay, underload timing relay, and A.C. overload and leakage relays. The arrangement is seen very clearly in Fig. 4, which shows also the gallery where the D.C. circuit-breakers are situated.

The direct-current switching equipment includes :—

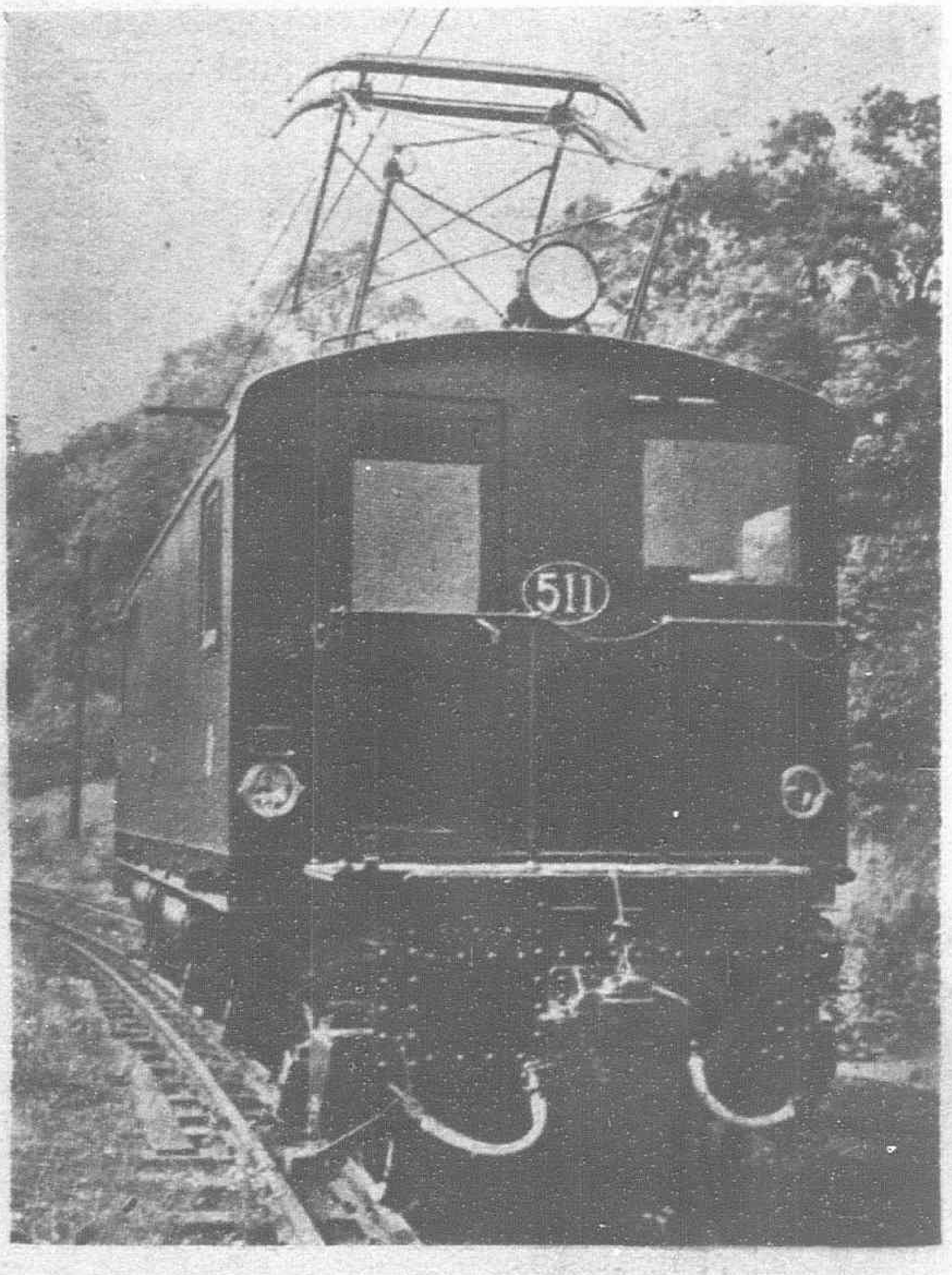
Two 2,000-ampere, 1,500-volt positive contactors.

Two 2,000-ampere, 1,500-volt machine high-speed breakers with limiting resistance.

Four 2,000-ampere, 1,500-volt feeder high-speed breakers with auto re-close relays.

The D.C. meters and high-speed breaker controls are mounted on the desk control board, along with the master time switch and start and stop push-buttons.

Each machine has its own camshaft controller, which performs the operation of starting on tap voltage and eventually of synchronizing. The transformers are controlled on the H.T. side by motor-operated oil breakers, the supply to which is controlled by a motor-operated incoming feeder oil breaker. Once this incoming feeder breaker is closed the station is ready for starting.



English Electric 40 Ton Freight Locomotive on the Ise Railway

Normally, the first set is started up by the operation of the master time switch, which gives a closing impulse to the oil circuit-breaker closing relay. The oil breaker having closed, the machines of the selected set run up on tap voltage, synchronize, and if the machine contactor and machine high-speed breaker and feeder high-speed breaker control switches have been previously closed, these breakers close and the set goes on load.

The machines are connected in series through a high-speed breaker shunting a limiting resistance. The negative of the low-volt machine is connected to the negative D.C. bus-bar, and the positive of the high-volt machine is connected through a contactor to the 1,500-volt D.C. bus-bar. The closing circuits for the above have control switches on the control desk, which are permanently closed for automatic operation.

On heavy overloads or short-circuits the feeder breakers open, but a timing device permits them to re-close automatically after a definite time interval, which is fixed beforehand according to requirements. After a pre-determined number of unsuccessful attempts to close have been made, the affected feeder breaker is locked out and the lock-out device must be set by hand when normal conditions are restored.

The second set would only start up on the occurrence of overload of sufficient duration or magnitude, or in the event of some trouble developing on the first set. It may, of course, be started up for inspection at any time by operating a push-button switch on the control desk.

Shutting down is effected by the master time switch, or, if both sets are running, the second set to start up may shut down on underload and the time switch will shut down the set that was the first to start up. The sequence of starting up is pre-determined by switches on the control desk.

The exciters and field circuits of both sets are connected in series when both sets are running. When the second set is synchronized and in the full " run " position of the camshaft controllers, the field circuits of this set are automatically put in series with the field circuits of the first set, thus ensuring that the cold machines share the load equally with the running machines.

The machines are fully protected against the following faults :—

Incomplete or too slow start or failure to start. A.C. leakage. Overspeed. Hot bearings. Field failures. Wrong polarity. Failure to synchronize. A. C. overload. Single-phase starting. D. C. leakage.

If any of these troubles occurs the set concerned is locked out and the protective devices must be re-set by hand when normal conditions are restored. Protection is also affored for A.C. low voltage or failure, and D.C. reverse current. In either of these cases the set is shut down, but can start again with normal conditions prevailing. Should a machine become overheated, the machine thermostat is operated, and causes the second set to start up if only one set is running. Should there be two sets running or should one set continue to overheat, this relay opens the D.C. machine high-speed breaker and contractor, which re-closes again on the machines of the set concerned cooling down sufficiently. In the event of phase reversal occurring, the set is locked out and the relay must be re-set by hand after the fault has been rectified.

The substation plant and control equipment have been erected and put into operation by the railway company's engineers ; they form a notable addition to the long list of English Electric automatic equipments in routine service in all parts of the world.

Rolling Stock on the Ise Railway, Japan

In addition to the substation equipments described in the foregoing article, this railway has also in service locomotives and motor-coach stock equipped on the " English Electric " camshaft control system.

The unit illustrated is a 40-ton freight locomotive of the 0—4—4—0 articulated four-motor type for operating on a 1,500-volt direct-current system with overhead current collection. The control provides nine series and six parallel operating positions, with rheostatic braking to supplement the Westinghouse air brake and the hand brake equipment.

In accordance with the Company's practice these locomotives were tried out on their test track in order to ensure satisfactory operation in the customer's service.

The adoption of the same control system on the multiple-unit cars indicates that it meets the requirements of the railway for the varied traffic conditions met with on this line.

High Frequency Crucible Steel

New Process for Producing a Refined Steel Representing the Acme of Efficiency

By Dr. Eng RUDOLF HOHAGE and Dipl-Eng. BERNHARD MATUSCHKA

At all times inventors and scientists have tried to cope with the growing demands of industry. It is an old experience that the demand creates the supply and that whenever the means available become insufficient an ingenious idea makes its appearance which holds out new and unexpected prospects. One of these creations is the

High Frequency Crucible Furnace

Up to a few years ago the only process known by means of which steel of the highest quality could be produced was the crucible process. The crucible steel was exclusively made in coke or gas heated crucible furnaces. The raw materials charged were high quality pig iron from Sweden, Lancashire iron, Styrian puddled steel, as well as the best scrap from the own production of the steelworks, the additions consisting of the purest alloys. This high quality charge was either introduced into a clay crucible and melted in an underground furnace filled with coke (to this day chiefly used in England) or in a graphite-clay crucible placed into a gas heated furnace (on the Continent).

The gas furnace is heated in a similar manner as the Siemens-Martin (open hearth) furnace by the combustion of a gas and air mixture preheated in special heating chambers. The gas flame which burns with an excess of air of about 20% envelops and heats the crucible, the carbon content of which is partly consumed during the process under the action of the fire gases. As this renders the crucibles porous it is inevitable that during melting the charge be acted upon by the air contained in the crucible, by the oxide skin of the charge and by the heating gases penetrating into the crucible through the pores so that the melting process in the crucible takes place under a slightly oxidizing atmosphere. The further introduction of oxygen is prevented by the slag, which forms a continuous cover on the surface of the bath. After the charge is melted the so-called crucible reaction or automatic reduction of the steel begins. The silicon which migrates into the steel from the crucible walls in statu nascendi *i.e.* in a highly reactive state causes an energetic reduction of the steel. To this automatic reduction and cleaning as well as to the purity of the materials charged, the crucible steel owes its excellent properties.

It is only natural that such a subtile process involves high costs of production. The task of maintaining the quality whilst reducing the costs was successfully solved by the invention of the electric steel process. In its two embodiments as arc furnace and as induction furnace the electric steel process has stood its test in practical work for several decades, and has proved an excellent means for the production of high quality steels.

With the induction or low frequency furnace a current of only 15—25 periods per second is produced in a special transformer plant which is then transmitted by way of induction to the steel placed in the melting groove. In order that an energetic heating current be induced in the melting groove a closed circuit must be provided. This type of furnace is particularly adapted for refining liquid charges coming from an open hearth (S. M.) furnace. The cross section of the groove must be as small as possible so as to assure a rapid heating of the melting charge. This leads to the construction of narrow melting hearths, which are not easily accessible, the execution of metallurgical processes being impeded by the fact that the slag is only heated through the steel. An advantage of this system is the rotating motion caused by the current, which brings about an energetic mixing up of the steel bath. This motion, however, should not be too strong, as otherwise some of the fire resisting material of which the groove walls are composed would get into the steel.

The widest spread type now-a-days is the electric arc furnace. It is supplied with current from the power mains by way of a high voltage-low voltage transformer. The furnace current of high intensity is conducted through broad copper rails to the three electrodes, which form arcs with the solid or liquid metal so as to rapidly melt the charge. After melting, the arc also heats the slag which transmits the heat to the steel bath. In consequence the slag is always hotter than the steel, so that all metallurgical processes can be carried out easily and completely.

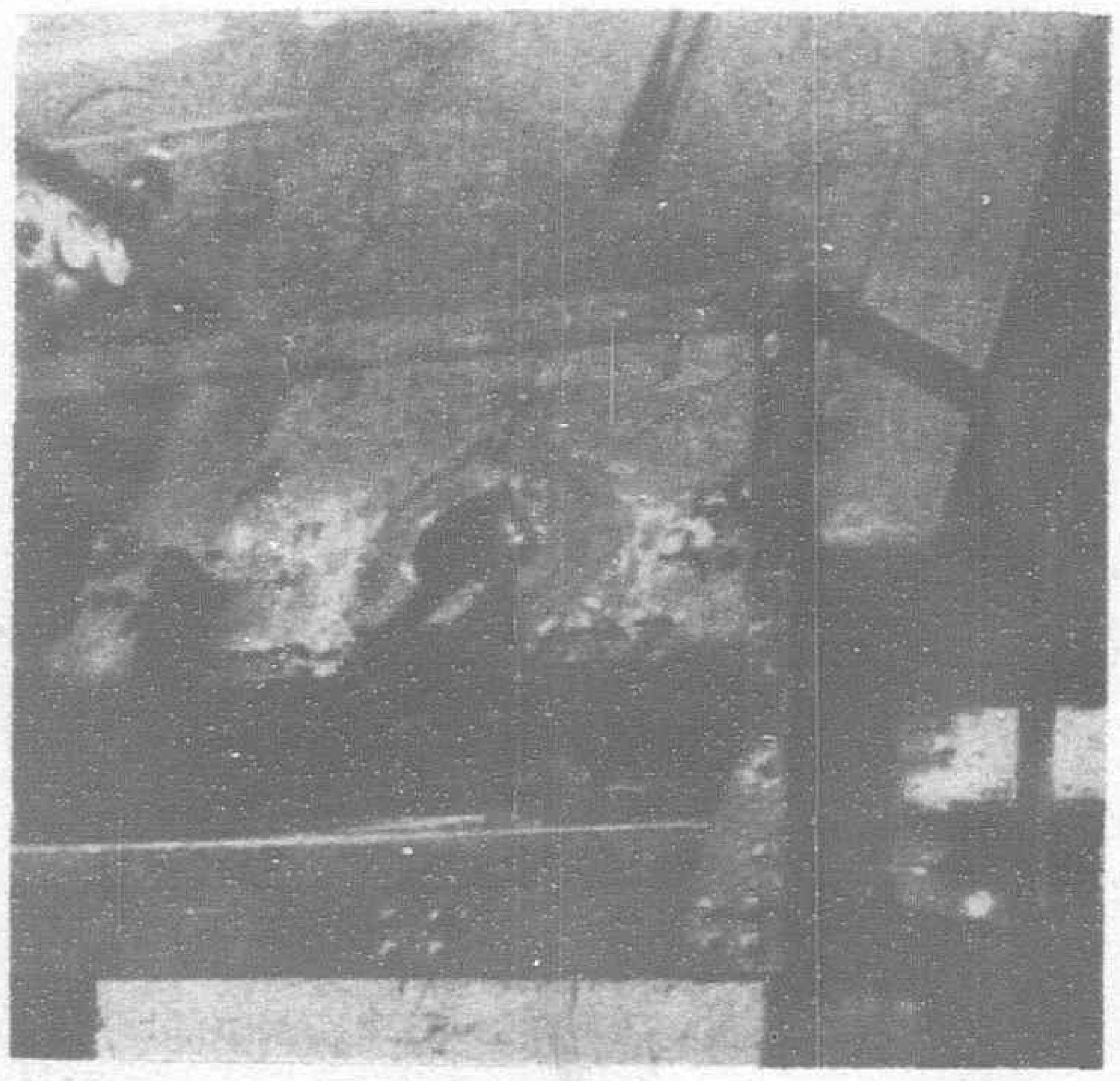


Figure 1

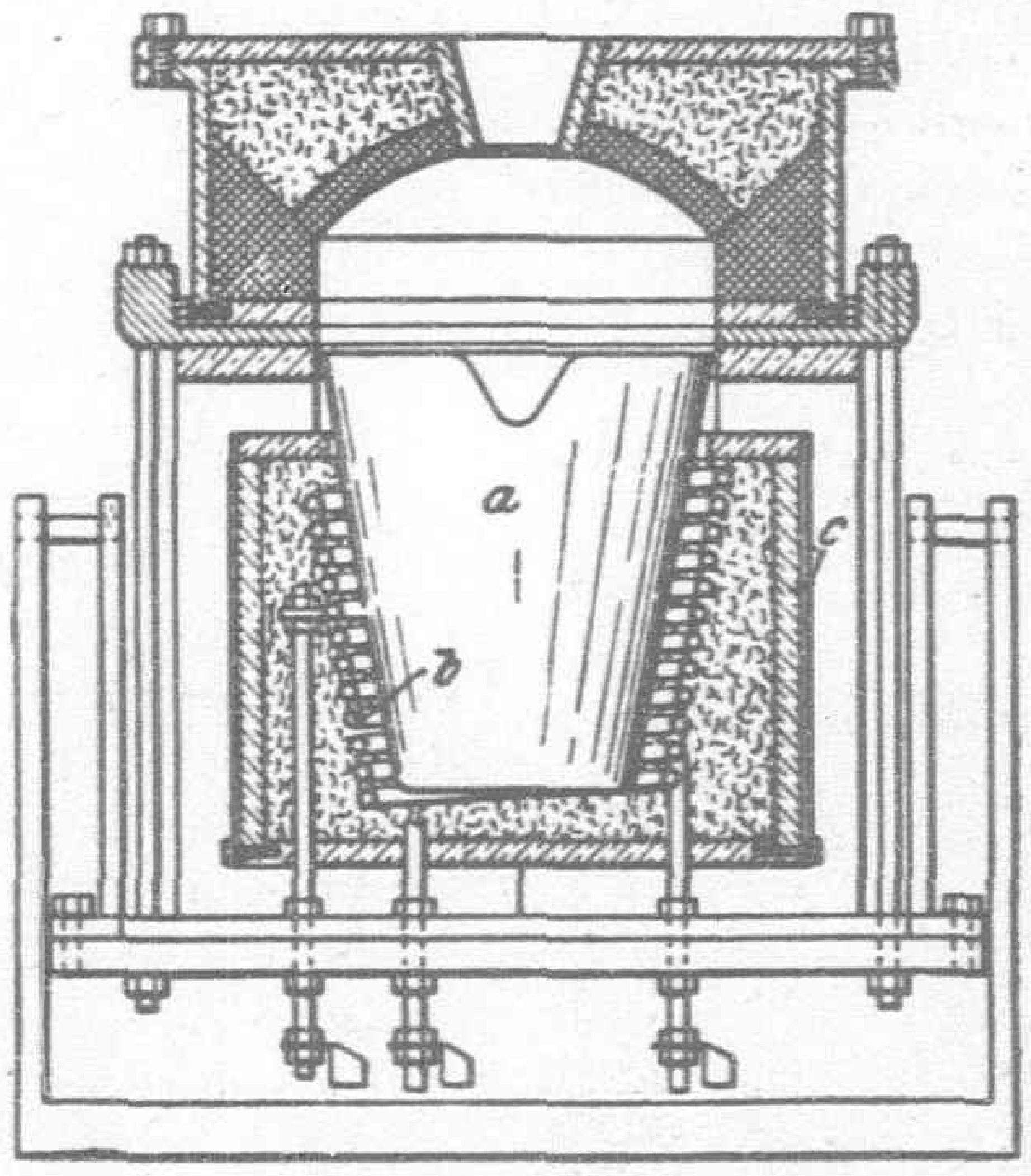


Figure 2

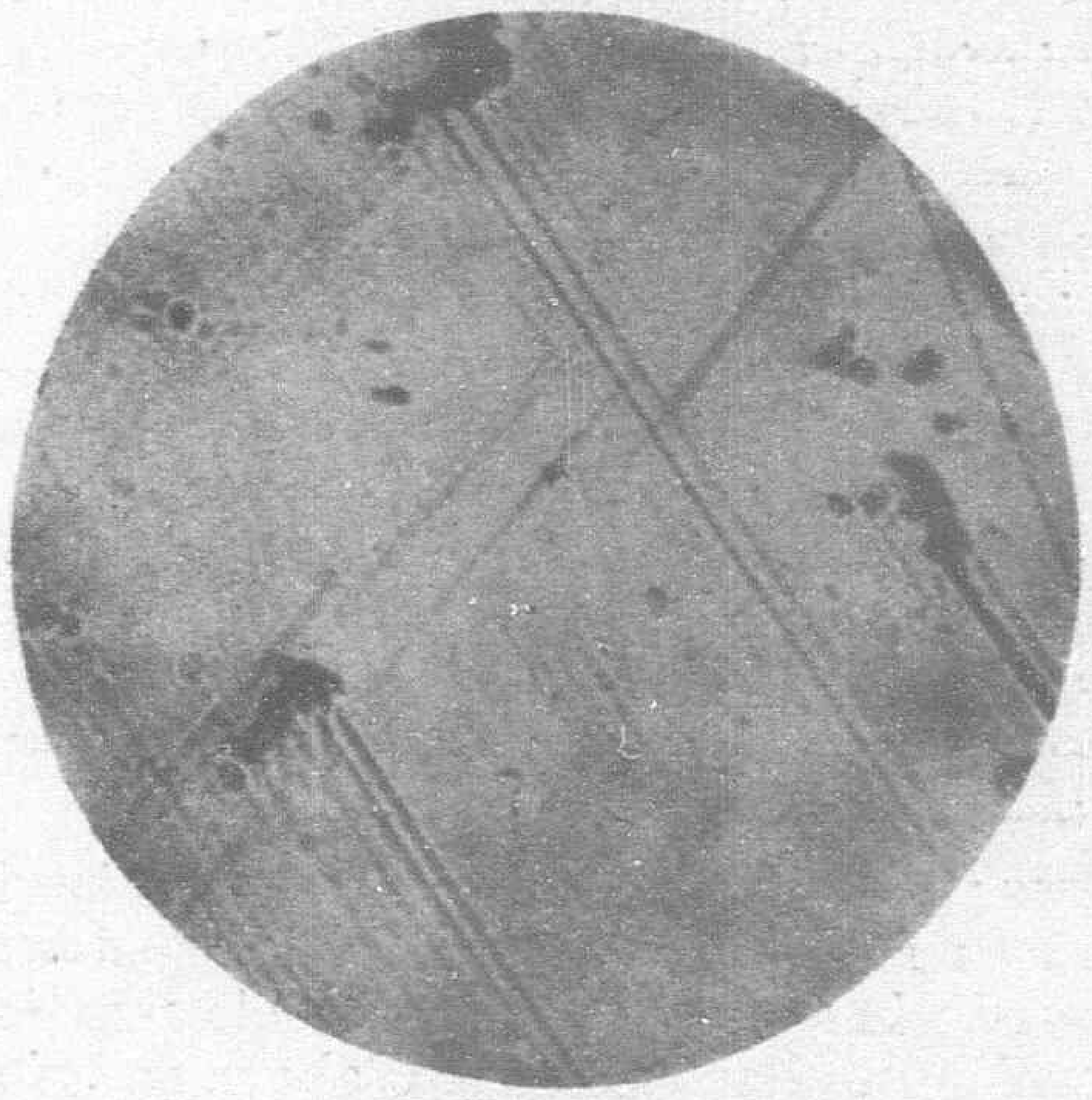


Figure 3

The arc furnace is excellently adapted for the production of a well reduced steel of any composition desired. However, there is no electric mixing with this type of furnace so that as in the S.M. (open hearth) furnace an artificial boiling period or an energetic mechanical stirring are indispensable.

Notwithstanding the high degree of perfection to which the electric steel process, as described above, has been developed in the course of years, it has still some weak points which render it incapable to compete with the old crucible steel in respect to a number of steel qualities. This explains the fact that many industrial establishments and repair shops still cling to and demand for certain purposes the far more expansive crucible steel on account of its purity and its working reliableness.

The problem of the electric production of crucible steel has recently been solved in a brilliant manner by the inventor of the High Frequency Crucible Steel. The high frequency crucible steel furnace such as it has been erected by the Schoeller-Bleckmann Steel Works as first specimen in Austria and one of the first on the Continent is an electrically heated crucible furnace as illustrated in figure 1, figure 2 giving a section through the furnace. The

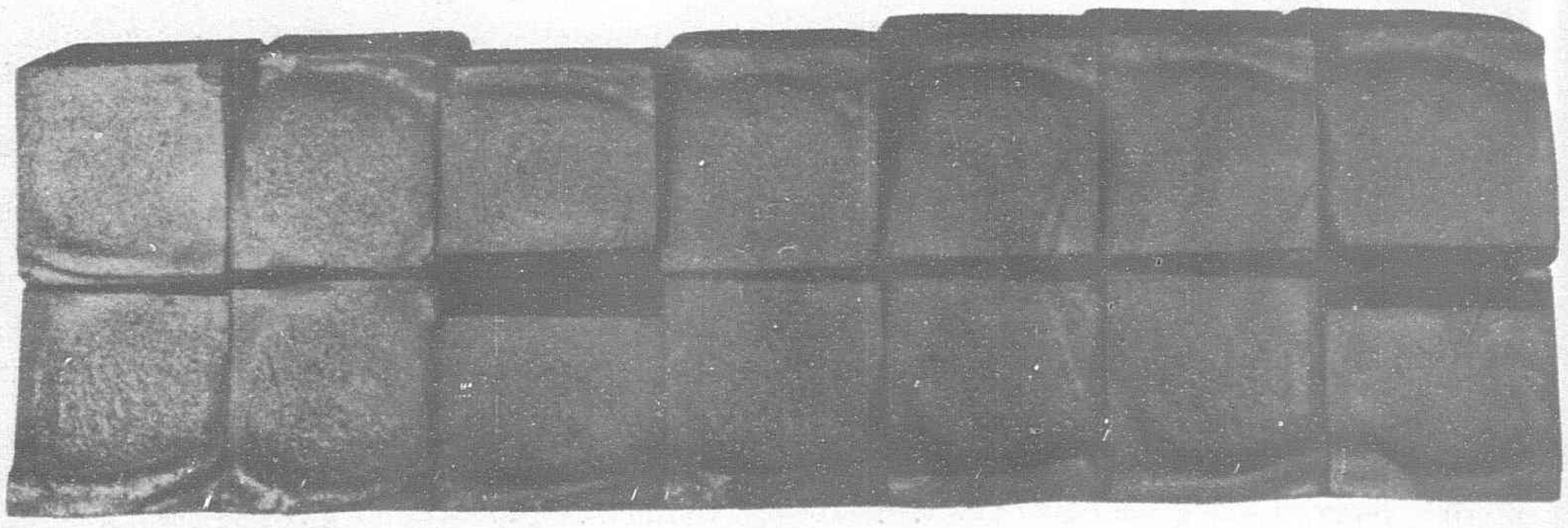


Figure 4

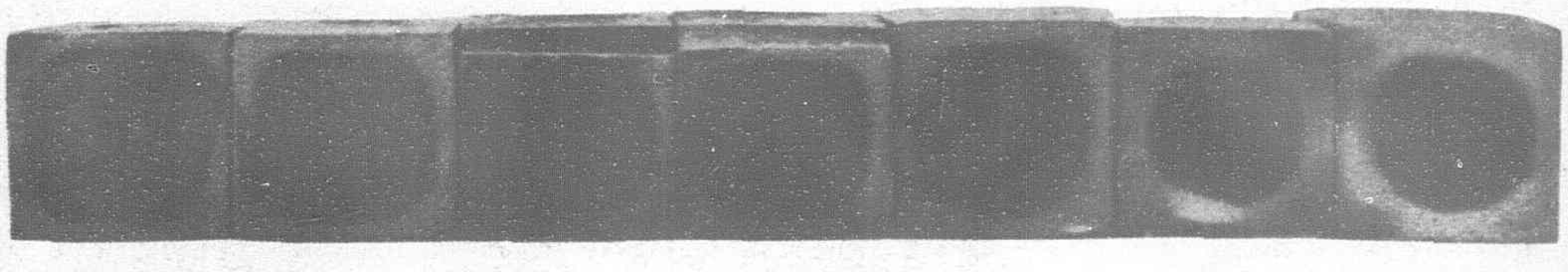


Figure 5

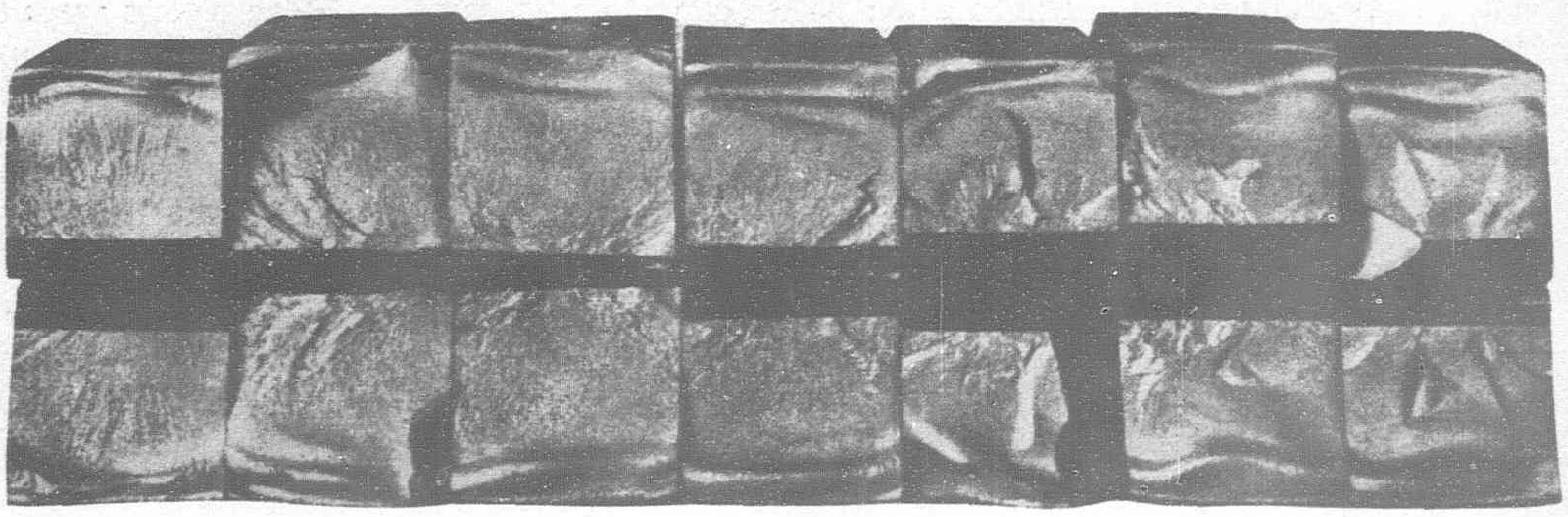


Figure 6

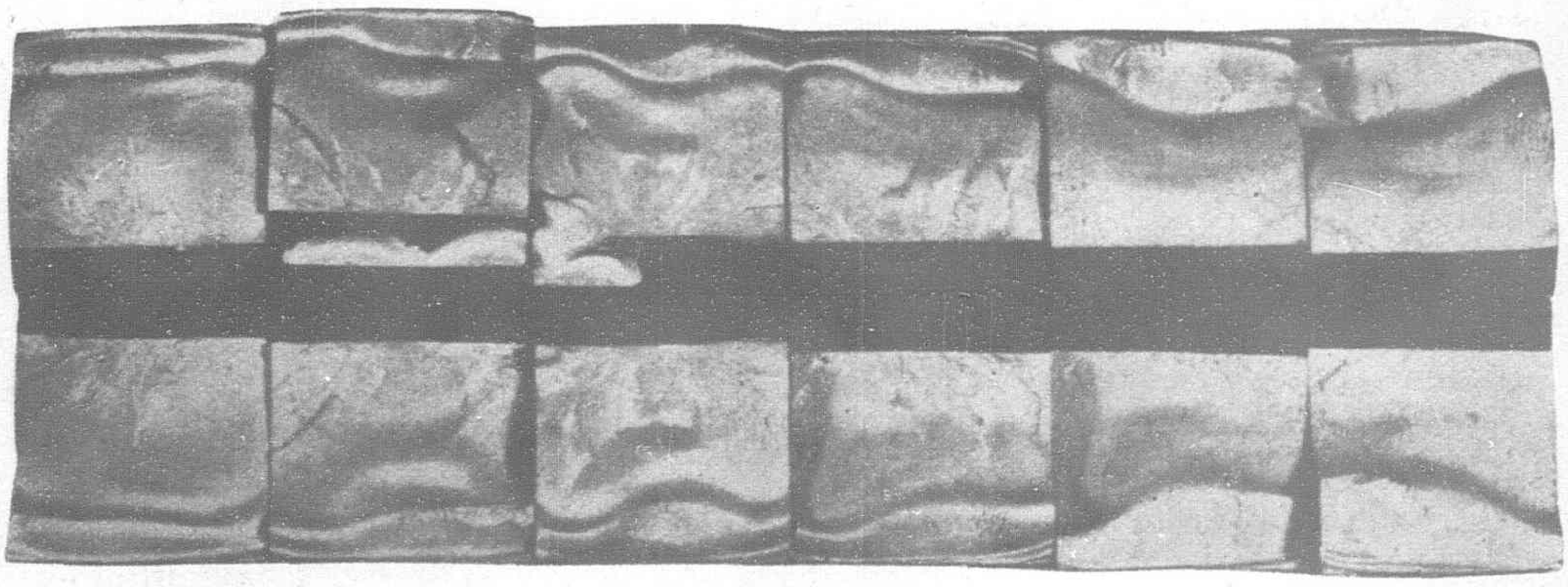


Figure 7

crucible which is made from an acid crucible mass is surrounded by the windings of a water cooled high frequency coil, in which a current flows changing its direction 3,000 times per second. This current is produced by a special high frequency transformer plant. Besides this furnace circuit there is a battery of electric condensers which takes up the current not consumed in the furnace that in consequence cannot flow back to the machine. By means of this arrangement, which has been devised by the American Northrup it is possible to attain such a high coefficient of efficiency that this new process can economically compete with all other steel production methods. The rapidly alternating current which flows through the furnace coil produces in the interior of the crucible a rapidly pulsating, magnetic field which induces in the charge electric eddy currents of such intensity that same is highly heated within a short time. In scarcely 60 minutes the whole crucible charge of 300 kg is melted down, a performance which has not yet been attained by any other furnace. The perfectly indifferent electric heating set up in the steel itself without further help and devices places us in a position to execute the crucible process in the high frequency furnace at a degree of perfection hitherto deemed unattainable. A first class charge consisting of Swedish pig iron, Lancashire iron, puddled steel, spongy iron and purest scrap are melted down together with the best alloying steel in the high frequency furnace, simply under the influence of the currents set up in the charge. This process does not require more than a few minutes and takes place in the total absence of noxious fire gases, even the air being excluded as far as possible. When melted the charge is exposed to the excellently reducing effect of the highly heated crucible walls just as in the crucible furnace heated by gas ; the silicon of the walls migrating in statu nascendi into the liquid steel and producing the so-called crucible reaction which we have described above as being the chief factor making for quality. There are other advantageous points, however, in favor of the high frequency furnace. The magnetic fields set up in the steel bath by the high frequency current will generate movements in the steel, which result in an uninterrupted slow and automatic mixing up of the same. Thereby the steel is automatically conducted past the highly heated crucible walls and is in all its parts subjected to the reducing effect of the crucible reaction. At the same time this slow and continuous motion (which is far from being so violent as the rotating motion in the low frequency furnace) will conduct upwards and thereby eliminate out of the steel all small slag parts and gas bubbles suspended in the steel, so that by means of this process a steel particularly pure and free of slag is obtained. It goes without saying that this electric stirring has also a beneficial influence when producing richly alloyed tungsten, chromium, vanadium etc. steels, warranting a uniform distribution of the alloys added and improving thereby the quality of the steel.

The high frequency steel surpasses in purity all steels made by other production methods even the steels produced in the old type crucible furnace.

How the purity of a steel affects its quality shall be discussed in the following :

Each inclusion or slag particle means an interruption of the metallic continuity impairing thereby, for instance, the quality of the polish. Figure 3 represents a piece of a plating roll for gold foils. The steel was melted in a 10 ton electric furnace. At the places of the fine inclusions (sonims) small cracks will appear when polishing which in time will destroy the roll, and which in any case have a very injurious effect on the foils.

It is a further disadvantage that the inclusions (sonims) will diminish the resistance of the metal against chemical influences, acids and medicinal agents are sure to eat into and corrode the fine slag parts adversely affecting thereby the polish of surgical instruments or of cutlery.

However, special attention should be paid to these sonims in case of tools made of such steel being hardened, the hardening process being bound up with a change of volume. In consequence a hardened piece of steel has a lower specific weight than the same steel in an annealed state. Owing to this change of volume during hardening there are tensions in each piece of steel hardened.

If a steel is interspersed with sonims, these sonims do not take part in the hardening process *i.e.* the change of volume, being bodies of quite a different kind. The spaces which contain the sonims will, therefore, cause disturbances and discontinuities of the tensions which will be the greater and the more injurious the greater the quantity of these sonims. Even the sub-miscropic sonims will have an adverse effect; though the individual disturbances will not be very considerable, they will make themselves disagreeably felt by the great number of repetitions.

These short considerations will give an idea of the importance of the purity of the steel. The following example strikingly illustrates this state of affairs.

It is a demand put forth in connection with certain draw plate steels that when rehardening the plate, the draw hole should be become narrower, so as to re-obtain simply by hardening the original size of the hole, in case the same should have been worn out by service. The purer the steel the more hardenings it will stand, before it cracks, and the more economical the tool.

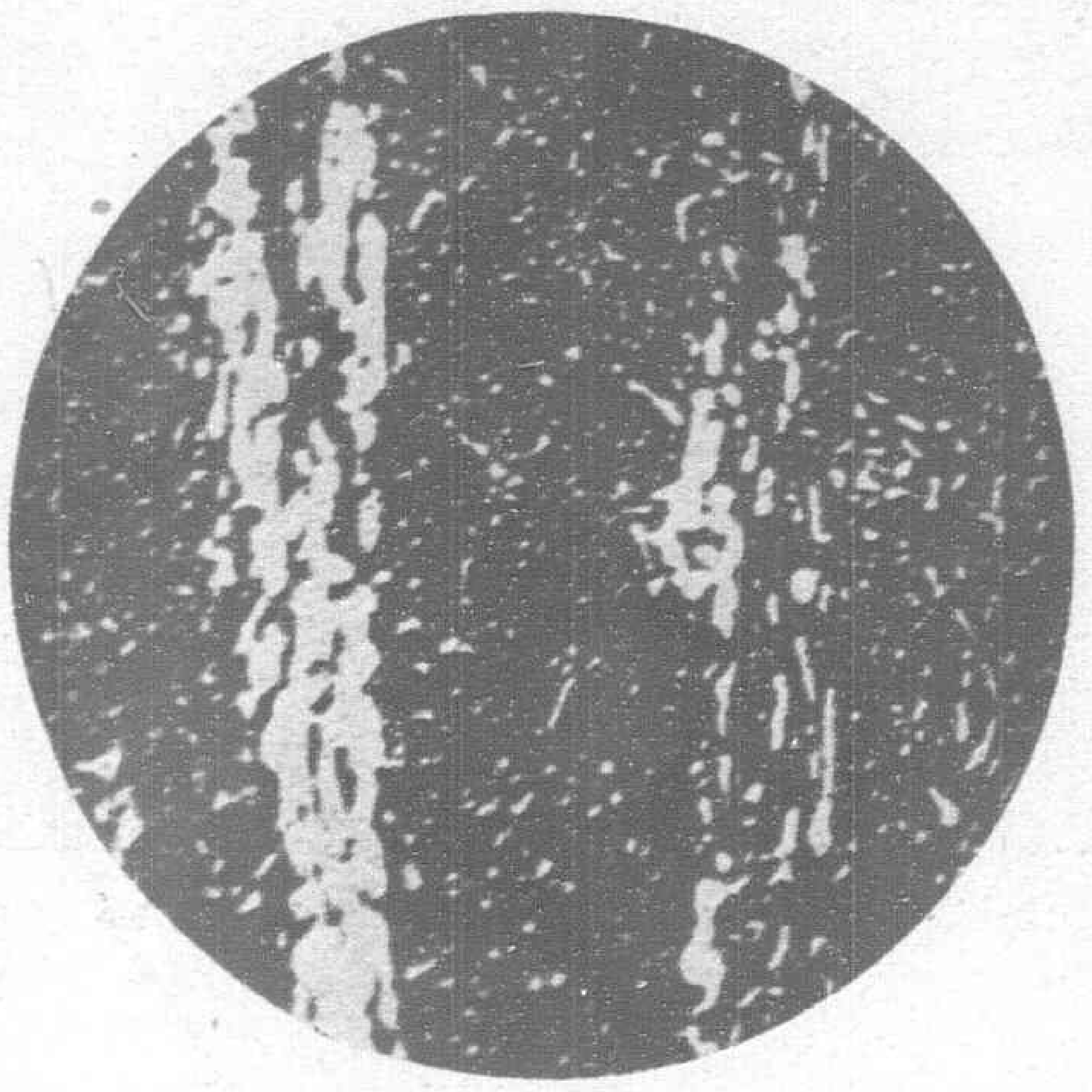


Figure 8

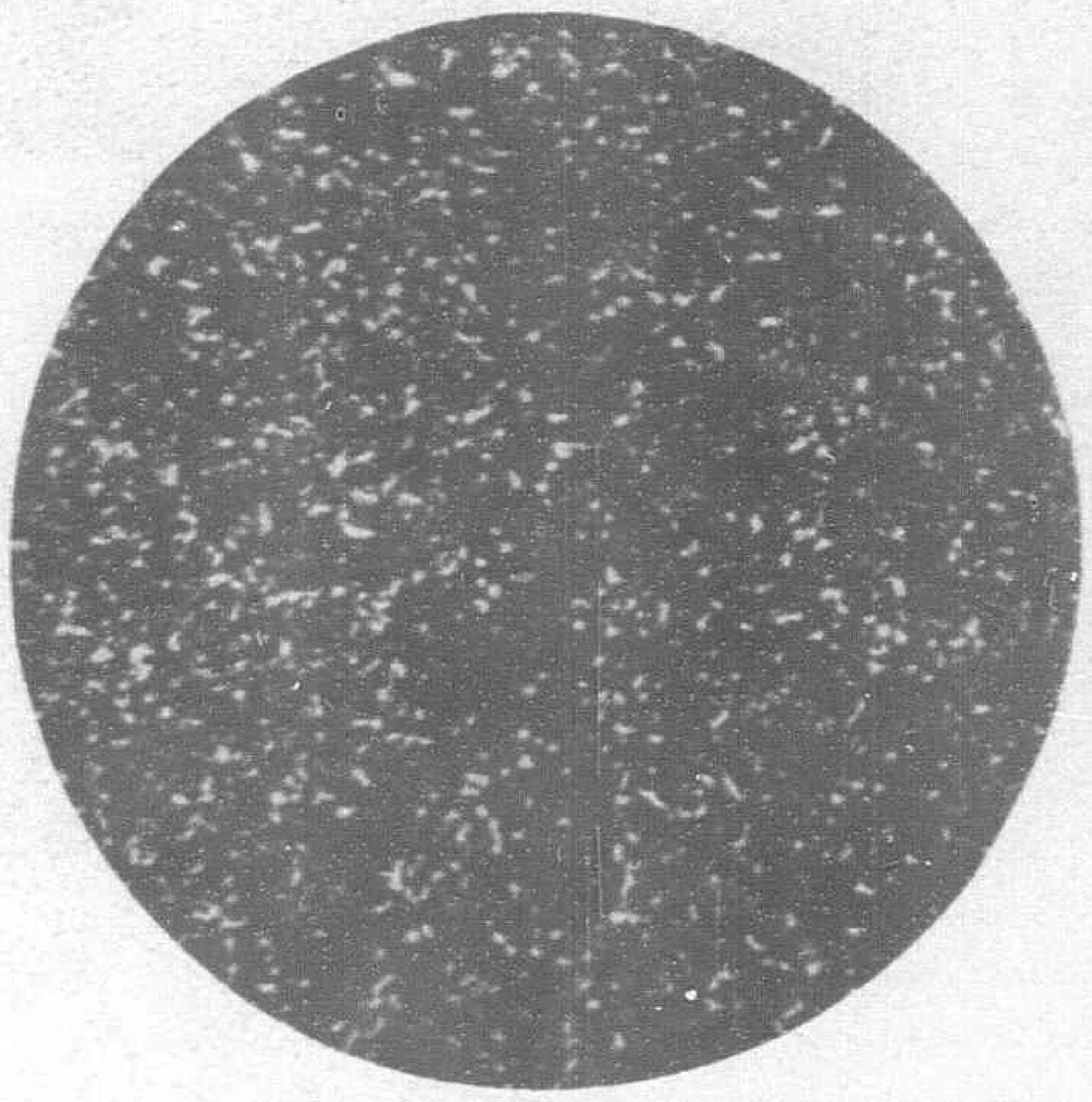


Figure 9

The susceptibility of a steel against hardening can be ascertained by two methods:

1. The multiple hardening test.
2. Interval hardening test.

The first test consists in steel cubes being finely ground and then hardened so many times until a fine crack appears.

For the second test a forged and normalized bar is used (the normalizing being required for suppressing the faults made during forging if any). From this bar equal pieces are cut off which according to the quality of the steel are hardened between 700 and 900° C at intervals of 20° C each. The appearance of the fracture then permits to state whether the steel was free of sonims or not. Figure 4 shows a pure high frequency steel (carbon steel with 1.05% C, 0.12% Si and 0.25% Mn) as an example of the intervals hardening test. The fine hardened rim and the tough core can be clearly distinguished even at a hardening temperature of 880° C.

It should be noted that whilst the standard hardening temperature is 760°, no hardening cracks have appeared in the steel superheated by 120° C. Figure 5 shows the etched slides of the fracture series seen in figure 4. The steel is so pure and so proof against injurious influences that even at a hardening temperature of 880° C there is still the fine rim or border due to hardening and the tough core showing that the piece was not hardened through *i.e.* had not turned brittle.

The pure tungsten steels and the tungsten steels containing a slight percentage of chromium the so-called "Diamond" steels having a content of 4%-6% of tungsten and about 1.4% of carbon are suffering under the disadvantage that tungsten subcarbides are separated which afterwards do not participate in the hardening process, consequently, the maximum hardness, which is a characteristic feature of these steels is diminished and the steel is difficult to harden. This unfavorable quality is not found in the high frequency steel as has been ascertained beyond doubt by detailed experiments. Figure 6 shows the interval hardening fracture series of the 4% tungsten steel, which is employed for draw plates, cartridge case drawing dies and similar tools, figure 7 referring to a fluting steels of $5\frac{1}{2}$% tungsten. Up to a highly superheated hardening at 880° C all fractures are crack freed and the lustre of the surface of the fracture which is noticeable even in the specimens most highly superheated clearly denotes the purity and the high quality of the high frequency steels.

Furthermore, the sonims contained in the steel exercise a great influence on the distribution of the carbides in all steels which contain a high precentage of the latter. The purer the steel the finer the distribution of carbides, the better the tool. Besides the carbide distribution is strongly affected by other factors especially the casting temperature. There again the high frequency furnace offers a tremendous advantage, as it is easily possible to obtain any casting temperature desired, to cool down the steel by cutting off the current or to bring it to a higher temperature by heating up. A striking example regarding the differences in the distribution of the carbides in the same steel is shown by the comparative illustrations 8 and 9.

As may be seen from the above the invention of the high frequency furnace holds out the prospect of a never dreamt of improvement of the quality of refined steels.

The Schoeller-Bleckmann Steel Works are devoting all their energies to the further development of this new process, which promises to produce steels warranting an unequalled performance.

Hongkong-Canton Telephone Line nears Completion

The work of constructing the Hongkong-Canton Long Distance Telephone Line which began some six months ago is now approaching its final stage.

The line linking up from Hongkong to Shun Chun in the Chinese section is undertaken by the Hongkong Telephone Company. The submerged line across the harbor to Kowloon had been laid in the early spring of this year.

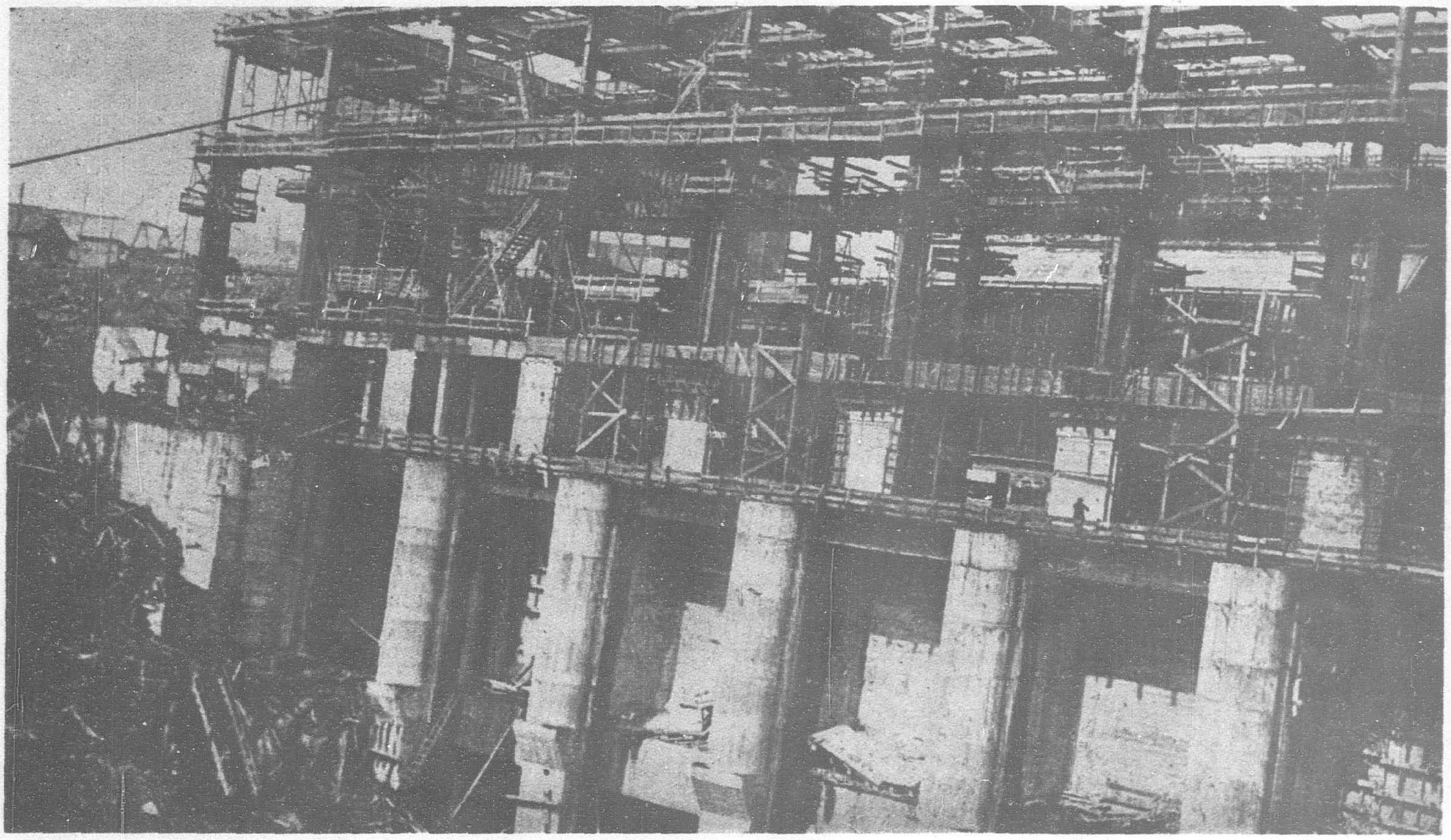
The distance of the whole line from Hongkong to Canton measures about 120 English miles. More than half the length of this line had been under completion during last year. Within these few months over forty miles are rapidly nearing completion, and there remain only about twenty miles to go before the whole line will be completed.

According to the building contractor of this line, eighty per cent of the work has been covered, and it is expected that the telephonic service between Hongkong and Canton will be able to communicate between these two metropolies at the end of this month. It is understood that the contracting company which undertook to build this trunk line is pressing the workmen to go at full speed with their work in order to finish their task before the specified period as fixed in the agreement between the China Electric Company and the Chinese government.

With regard to the Chinese section of this trunk line, the Chinese government is solely responsible for the enterprise of this undertaking, although the contracting work has been entrusted to the China Electric Company. The company provides for the initial expense for the contruction of this line.

It is learned that the Canton Municipal Government will repay back the loan to the China Electric Company by installments plus four months interest of eight per cent per month.

The company will hand over the administration of this long distance telephone concern to the Canton government until the whole amount of the funds had been repaid. It is stated that the expenditure for the building of this trunk line in the Chinese section amounts to over $7,000,000.



View of a Section of the Dnieper River Power Plant under Construction

Electrification Plans of the Soviet Union

The first plan for the electrification of the Soviet Union, the Goelro (State Electrification Commission) Plan, was published in December, 1920. It was drafted on the initiative of Lenin and was intended to serve as the basis for the industrialization of an essentially agrarian country. This program was launched at a time when the Soviet Union was suffering from the dire after-effects of the world war, the revolution, foreign intervention and civil war. The country was completely disorganized, industrial production having fallen to 20 per cent of the pre-war level and agricultural production to 34 per cent. Coal mining had come practically to a standstill, blast furnaces were cold, and the break-down of the transport system had dislocated intercourse between the various sections of the country. Under such conditions the Goelro plan to raise the economic status of the country to a high level met with considerable adverse criticism both at home and abroad. At the present juncture—ten years after its compilation—it is of special interest to examine the details of the plan, and to compare the results attained in the electrification of the country with the degree of progress outlined by the plan of 1920 as essential to establish a basis for its industrialization.

The Goelro Plan

The Goelro plan mapped out a program of industrial construction and production over a period of from ten to fifteen years. Actually this program only began to be carried out in 1922. Within the period indicated it was planned to raise the level of industrial production as a whole 80 to 100 per cent over that of 1913. At the close of the past fiscal year (ending September 30, 1930) the total industrial production of the Soviet Union was already double that of the pre-war period; in other words the Goelro plan, from an industrial angle, has been more than realized within ten years, the minimum period set.

In the field of electrification, the basis of the entire program, the plan mapped out was very ambitious, so much so that the general attitude towards it was one of great scepticism. However, the results have more than justified it and exceeded even the most sanguine expectations. The plan specified the construction within a period of from ten to fifteen years of thirty central power plants, with a total capacity of 1,500,000 kilowatts. The output of all power stations was estimated to equal 8,000,000,000 kilowatt-hours, or about four times the pre-war output, by the end of the period.

On the occasion of the tenth anniversary of the Goelro plan in December, 1930, the situation as regards the development of electrification was as follows:—

	Kilowatts
Capacity of central stations	1,300,000
Capacity of all stations	2,800,000

	Kilowatt Hours
Annual output of central stations	4,000,000,000
Annual output of all stations	8,800,000,000

The program for 1931 anticipates the following capacity and output in the field of electrification:—

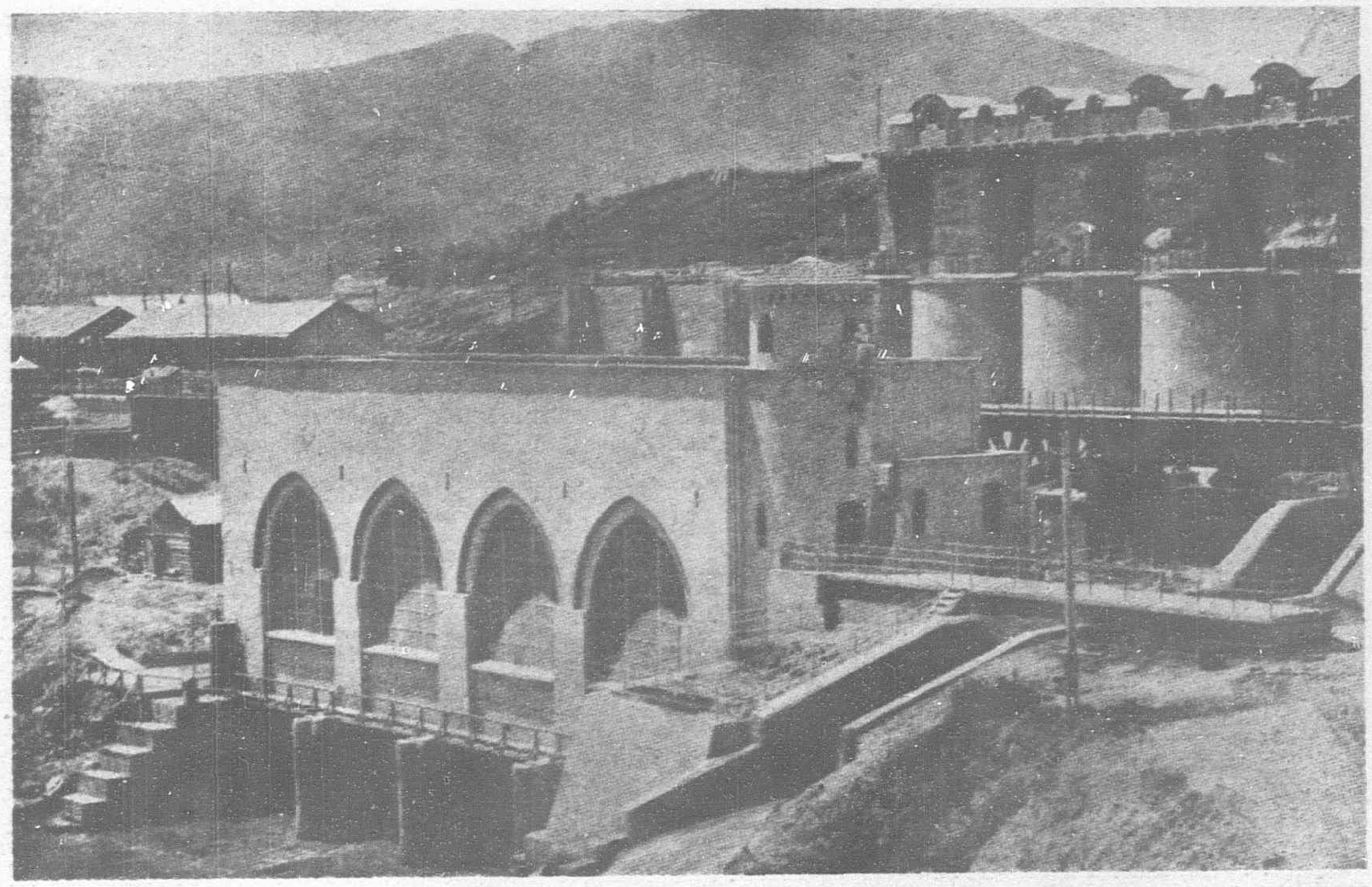
	Kilowatts
Capacity of central stations	2,300,000
Capacity of all stations	4,500,000

	Kilowatt Hours
Annual output of central stations	6,800,000,000
Annual output of all stations	12,700,000,000

Thus by the end of the current year the capacity of the central stations will have exceeded that set in the Goelro plan by about 50 per cent, and the project which was regarded in many quarters with such scepticism ten years ago will be more than realized.

Result of Plan

During the period between 1922-23 and 1930 the capacity of all power stations in the Soviet Union rose from 1,495,000 kilowatts



General View of Zemo-Avchal (Zages) Power Plant near Tiflis, in Transcaucasia

to 2,800,000, as against 1,078,000 kilowatts in 1913. Production to electrical energy increased more than threefold during the same period, equalling 8,800,000,000 kilowatt-hours by December, 1930, as compared with 2,600,000,000 in 1922-23. In 1913, production amounted to 1,945,000,000 kilowatt-hours.

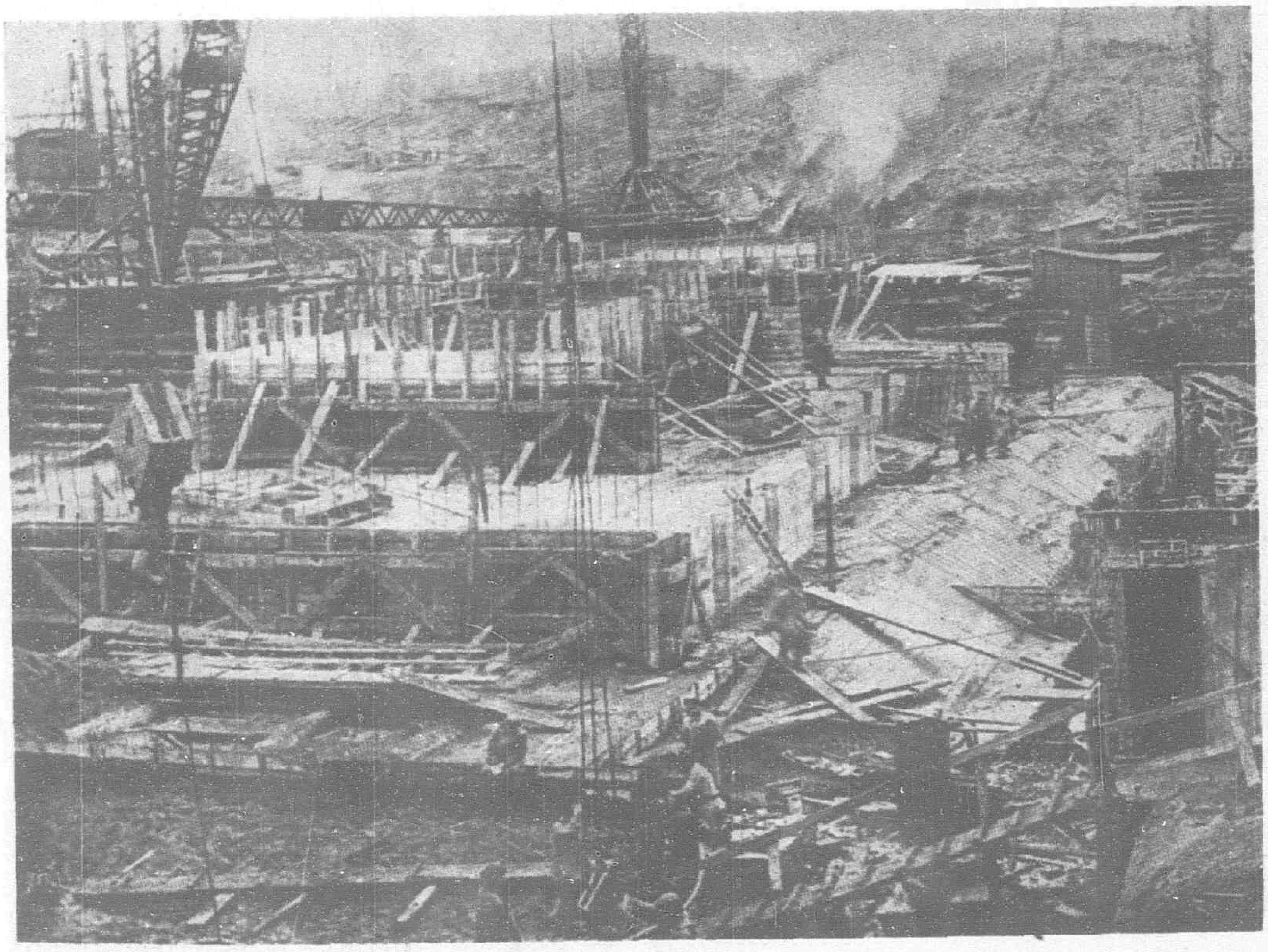
Capital investments in electrification in 1929-30 were more than twice those of the year before, and eight times that invested in 1925-26. The sums invested in these years were 800,000,000 roubles ($400,000,000), 300,000,000 and 100,000,000 roubles respectively. During the current year expenditures for new construction will total 550,000,000 roubles and total investments will equal 865,000,000.

The Goelro plan was revised and amplified by the Five-Year Plan adopted in 1928. Although the original estimates of the Five-Year Plan were more than double the Goelro figures, in view of the considerable degree of development attained by 1928, the former was further revised in the autumn of 1929, when it become apparent that even in the Five-Year Plan the tempo of the industrial and agricultural development of the U. S. S. R. had been underestimated. This revised plan has set the total power production for all plants at 26,000,000,000 kilowatt hours by 1932-33, the last year of the Five-Year Plan, and the capital investments for the five years at 4,500,000,000 roubles.

A picture of the annual progress of the work of electrification as compared with the program for each year, is given in the following table, showing investments and new power available through central electric stations over a period of four years :

Expenditures for Capital Construction

	1927	*1928*	*1929*	*1930*
	(in million roubles)			
Program	124	247	306	500
Achievement	92	178	257	390



Svir Hydro-Electric Power Station under Construction in the Leningrad Region

New Power Plant Capacity Available (in thousand kilowatts

Program	180	158	225	500
Achievement	112	100	150	540

The achievements in 1930 as compared with those of 1929 indicate a tremendous advance in the amount of new capacity available through the completion or partial operation of new power plants.

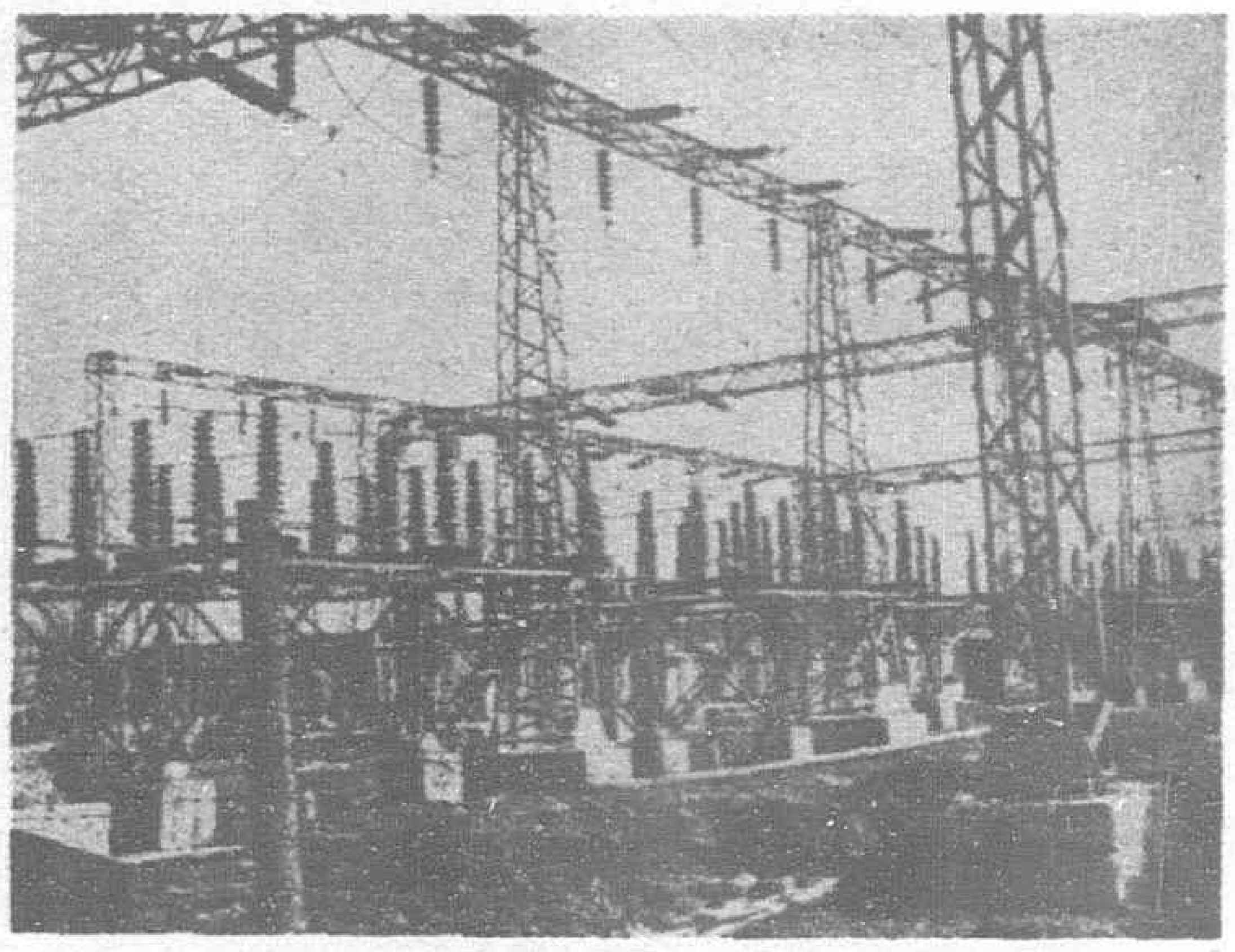
Although the increase in the production of electric power has been rapid, that in the proportion generated by the central stations has been even more rapid. In 1913 the percentage produced by the latter was 22.1 per cent of the total, and in 1927-28, the last year before the Five-Year Plan, 35 per cent ; for 1932-33 the percentage is now estimated at 73 per cent.

New Central Stations

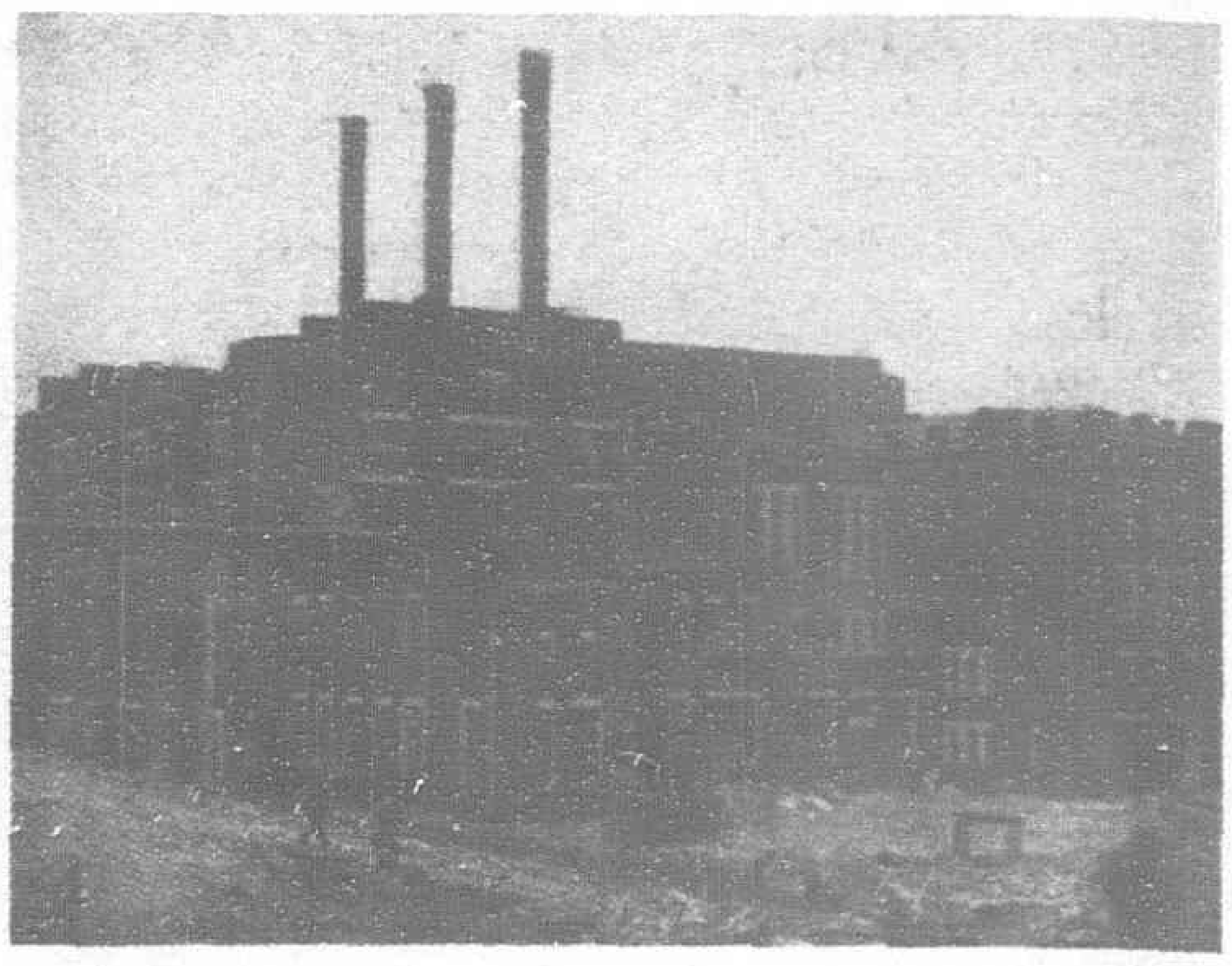
Twenty-two new large central stations have been constructed under the Soviet régime which, together with the nine central stations built in the pre-revolutionary period (31 in all), bring their total capacity to 1,300,000 kilowatts in December, 1930, or more than five times that of pre-war. The number of central power stations to be in operation by 1933 is set at 64, with a total capacity of 5,123,000 kilowatts, as against the present total of 1,300,000 kilowatts, and 250,000 kilowatts in 1913, while 12 new power plants, with a total capacity of 935,000 kilowatts, are also scheduled to be under construction by the end of the Five-Year Plan period.

The first large Soviet hydro-electric station constructed was the Volkhov station, 130 kilometers from Leningrad, with a capacity of 58,000 kilowatts. This station supplies power to the industries in and near the city of Leningrad. The most important power plants constructed in recent years and now completely or partially in operation include the Kashira central power station, connected with the city of Moscow by a 100-kilometer high voltage transmission line of 110,000 volts. This station is in the center of the Moscow

Electro-Physical Department of the Soviet Electro-Technical Institute at Moscow



Step-Down Substation of the 110,000 Kilowatt "Red October" Power Plant at Leningrad



Power Station at Kaluga, in the Moscow Region

coal basin and has a capacity of 40,000 kilowatts, which is to be increased to 205,000 kilowatts during the current year. The Shatura plants, 130 kilometers from Moscow, has a capacity of 136,000 kilowatts and is the largest peat-burning station in the world. The Balakhna station on the Volga, now partly in operation, has an estimated capacity of 86,000 kilowatts, and is also a peat-burning station, as is the "Red October" plant near Leningrad, which will have an ultimate capacity of 111,000 kilowatts. The bobrikov power plant near Tula (Moscow region) uses lignite; this plant has a present capacity of 174,000 kilowatts, which capacity will be ultimately raised to 348,000 kilowatts.

The central power station at Stalingrad (North Caucasus) was finished in record time, construction having begun in June, 1929, and operations started on the occasion of the thirteenth anniversary of the Soviet régime (November 7, 1930). The capacity is 44,000 kilowatts. The most outstanding power stations in the Ukraine are the Kharkov station with a capacity of 134,000 kilowatts and Shterovka with a capacity of 157,000 kilowatts.

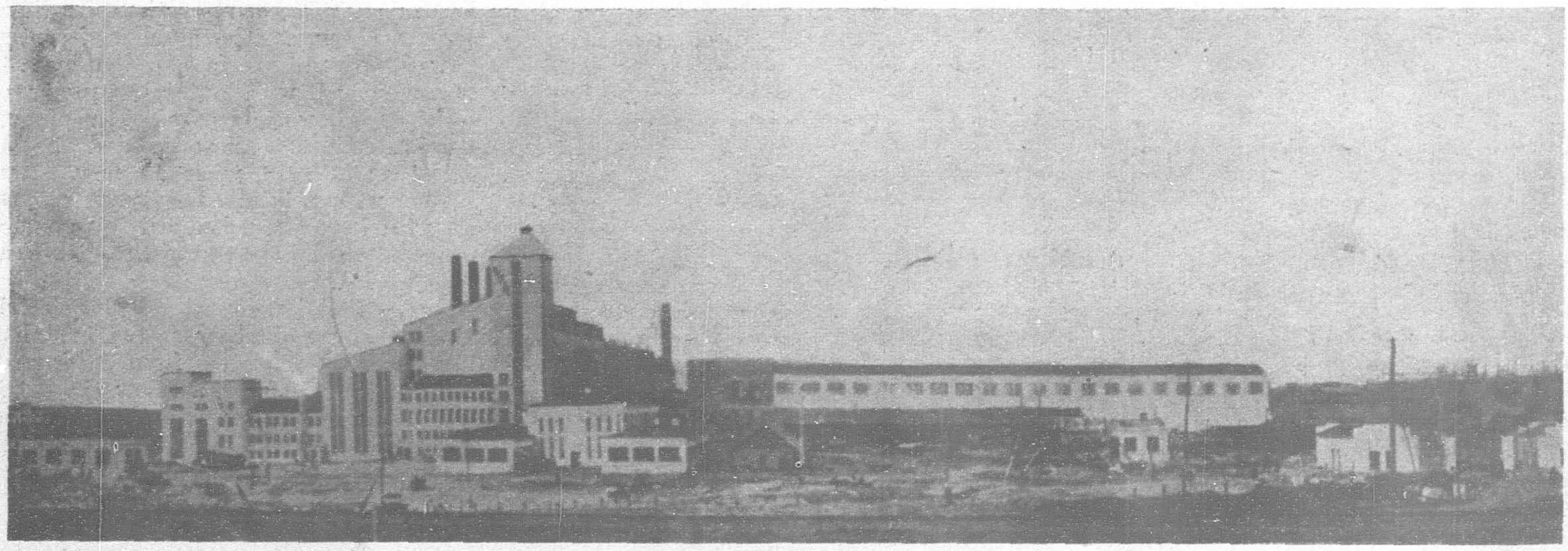
In November, 1930, the foundation was laid for the first central power and heating station in Kemerovo, Siberia, the capacity of which is set at 560,000 kilowatts,. This will be the largest power plant in the U. S. S. R. exceeding the Dneprostroy hydro-electric station in the Ukraine in capacity. It is expected to be in operation next year with an initial capacity of 144,000 kilowatts.

The Dnieper River hydro-electric plant, when completed, will be the largest hydro-electric plant in the world, with a total capacity of 558,000 kilowatts. Construction began in May, 1927, and is now about half completed. The total cost is estimated at $110,000,000. Colonel Hugh Cooper, the well-known American hydro-electric engineer, is the chief consulting engineer for the Dneprostroy project. The entire industrial combine which the hydro-electric station will serve comprises a steel plant, an aluminum plant, a chemical plant, etc. This industrial undertaking marks a new departure in the Soviet Union aimed at centralizing related industries in groups, to be served by a central power station. A large agricultural combine on the Dnieper River will also be served with power from the Dnieper plant. The construction of this station is an outstanding example of the success and scope of electrification in the U. S. S. R.

Two powerful hydro-electric stations are about to be completed in Transcaucasia; the Rion plant in Georgia with a capacity of 48,000 kilowatts, and the Dzoraget with ultimate capacity of 42,500 kilowatts. It is expected that these power plants will be in operation during the current year. The first hydro-electric station operating in Transcaucasia was the Xemo-Avchal power plant, the present capacity of which is 13,000 kilowatts, later to be increased to 37,000 kilowatts. The construction of a new hydro-electric station was begun in October, 1930, on the Niva River in Khibini, in the Arctic Circle, near the recently discovered apatite deposits on the Kola Peninsula. This station is scheduled to be completed by January 1, 1933, and the capacity has been set at 25,000 kilowatts.

New power plants are being constructed in the most remote regions in the Soviet Union, in the Arctic region, in the tropical regions, in the West and as far east as the Pacifie Coast. The program for the current year provides for construction work being started on a number of new stations with an estimated total capacity of 5,000,000 kilowatts. By the end of this year the new available capacity will equal about 1,500,000 kilowatts or a capacity as great as was planned in the Goelro plan to be attained in a period extending over fifteen years.

The Goelro plan also centered attention on the necessity of providing the country with cheap power. Peat was indicated as one of the fuels to be especially developed in this connection, and already by 1930 the annual peat output had increased to 6,500,000 tons as compared with 1,390,000 in 1920. In 1924-25, peat constituted 13.6 per cent of the fuel used in the production of electricity; this percentage has now increased to 40.8 per cent. Through



The Cheliabinsk Power Plant in the Urals—an Addition to the Older Station which will eventually have a total capacity of 140,000 kilowatts

the use of cheaper types of fuel and the allocation of power stations in so far as possible to those districts where such fuel is easily available, much has been attained in this field. Added to this the U. S. S. R. has had the advantage of utilizing the most recent scientific improvements in all the work of construction and reconstruction, where full attention is being given to the latest world attainments in the technique of electrification.

In spite of the achievements already gained in supplying both industry and agriculture with electric power, the industrialization of the country has developed so rapidly that the supply of power available in the more important industrial regions (the Donetz Basin, the Kuznetz Basin and the Leningrad, Moscow, Nizhni Novgorod and Ural Regions) lags behind the needs of industry. The expansion of existing plants and construction of new giant stations is being speeded up to cover these deficiencies.

The Commissariat for Agriculture has organized the United Agricultural Electrical Industry, the function of which will be the supervision of electrical construction work in rural districts. The Scientific Research Institute for the Electrification of Agriculture, at present in Moscow, will be removed to one of the large state farm centers, and will be a part of the new organization.

The Dnieper River power development at Kichkas, near Zaporozhye in the Ukraine, is proceeding ahead of schedule. It is now expected to start partial operations more than half a year before the time originally set.

The hydraulic turbines for the plant are being built and installed by the Newport News Shipbuilding and Dry Dock Company. The generators are being built by the General Electric Company in the U.S.S.R. under that firm's supervision. Both the turbines and the generators are the largest ever constructed.

Most of the imbedded parts of the nine turbines of 84,000 h.p. each are on the site, many of them already installed. The last was shipped from Newport News on May 1. The rotating parts of the first turbine are in process of erection, the second was shipped May 1, the third was shipped June 15, and the rest by June of next year. The parts of the first generator are being erected, and the second was shipped June 1. By the end of this year five of the generators will have been shipped.

The Dnieper River plant, which will serve an area of 70,000 square miles (a territory greater than that of all the New England States combined) and a population of 16 million persons, was originally expected to be completed in 1934, but the present indications are that it will be completed earlier. The cost will be about $110,000,000.

Construction of Dam

The progress attained during the 1930 construction season has advanced the projected initial date of generating electric power at the station to May 1, 1932, instead of December 1, as originally planned. Two units will be in operation in May, 1932, with three additional units to be installed during the summer of 1932. Thus, in a little over a year from the present date the plant will have an installed capacity of over 400,000 horsepower.

The basic operations call for 1,500,000 cubic yards of concrete, 2,300,000 cubic yards of rock excavation, 4,400,000 cubic yards of earth excavation, and 4,200,000 cubic yards of dredging. This work is estimated to require 300,000 tons of cement, 900 tons of explosives, and 100,000,000 board feet of timber.

Approximately 60,000,000 roubles, or about 25 per cent of the entire cost of Dneprostroy, were expended during the first two years of the project. The construction carried out during this two-year period, in addition to excavation and cofferdamming, includes the following: a temporary power station of 10,000 kw. capacity; compressed air stations with a total capacity of 9,500 cubic feet per minute; a plant for the manufacture of liquid oxygen with a total output of 220 pounds an hour; systems of water supply, sewage disposal, and fire protection; rock crushing plants on both sides of the river, each with a capacity of 250 tons per hour; concrete mixing plants on both sides of the river; sawmill and woodworking shop; central machine shop; foundries and blacksmith shops; a system of railroads with a total length of 62 miles; and a number of other structures. Also, during this preliminary period new living quarters were built for 20,000 people, to house the workers on the job and their families. Hospitals, schools, restaurants, and theaters were constructed during the two years.

This extensive program of preliminary work has made possible the successful continuance of the basic program, which was about two-thirds completed at the end of 1930. In particular, the permanent work on the dam, power house, bridges, and navigation facilities was ahead of schedule. In 1929 240,000 cubic yards of concrete were deposited and last year the total deposited was over 670,000 cubic yards. Dneprostroy established a world record in depositing concrete last year, the performance during October and November aggregating 267,000 cubic yards—a figure considerably above the best American record. It is estimated that an additional 650,000 cubic yards of concrete will be deposited in the permanent structures during this calendar year.

Description of Hydraulic Turbines

The power plant consists of nine hydraulic turbines with nine generators, each designed to develop 84,000 h.p. under a normal head of water of 116.5 feet, and over 100,000 h.p. under the maximum head of 123 feet.

The Dneprostroy turbines are of the single vertical type, with steel plate spiral casing. The latter is of one and one-eighth inch-thick steel plate and in form resembles an enormous snail shell. It is sixty-eight feet in width at its widest point.

The speed ring is immediately inside the spiral casing and serves to guide the water by means of guide vanes into the runner and also to transmit the superimposed weight above the turbine to the foundation below it. It is made of cast steel in four sections bolted together and weighs eighty tons.

In passing through the runner the direction of flow of the water is changed from horizontal to vertical and the water leaves the runner in a downward direction, passing through the draft-tube into the river below the dam. The draft tube creates a downward suction, thus saving part of the energy still remaining in the water which has left the runner.

The governor is of the 350,000-foot-pound actuator type and will operate the gates over full range in three seconds. It is sensitive to a speed variation of one-quarter of one per cent. The turbines and penstocks will weigh 9,000 tons and when they are all in operation under the normal head and developing their rated output, there will be passing through them over 27 million gallons of water every minute.

Description of Generators

The generating station will consist of nine water wheel-driven generators, each rated at 77,500 kva. and driven by an 84,000 h.p. turbine. Five of the generators are being built at the Schenectady Works of the General Electric Company and the other four in the U.S.S.R., with the co-operation of this company, which will furnish some of the parts.

The generators are the largest ever built, those at Niagara Falls which are rated at 65,000 kva. being the next largest. The total weight of each generator, excluding the water wheel, is approximately 1,760,000 pounds, the maximum diameter 42 feet, and the over-all height 40½ feet, with 17½ feet standing above the floor of the plant. Fabricated or welded construction is being used throughout to eliminate as far as possible large castings.

Due to shipping limitations the generator stator is being made in six sections, the punchings and windings in each section being assembled at the factory. On arrival at the site the six sections will be joined together and the joint coil inserted. This will save considerable time and labor in the construction of the stator at the site. The frame of each stator is built up of steel plates by means of electric welding and weighs 138,000 pounds. Shipping limitations necessitate each of the twelve arms of the stator being shipped separately. Its central ring, to which the arms are fastened, is 16 feet in diameter.

The generator shaft, which is being built at Schenectady, is the heaviest single piece to be handled. It is 36 feet long, 70 inches in diameter and nine inches in thickness, and due to its weight (136,000 pounds) must be shipped in a special car and routed in a roundabout way from Schenectady to New York to insure railroad clearances. Its upper end will support a vertical load of approximately 2,000,000 pounds, consisting of the weight of the generator, shaft, turbine, turbine shaft, turbine runner, generator, rotor and downward thrust exerted by the water in passing through the runner.

The rotor spider will be attached to the shaft by the spider hub, which is a solid steel forging holding the twelve fabricated steel arms. These arms in turn support a laminated steel rim, which will rotate at the rate of approximately 100 miles an hour when the spider revolves.

Coal Resources of Japan

Kyukichi Watanabe

Geologist for the Imperial Geological Survey of Japan

WITH regard to the existence of coal and lignite in Japan, a detailed description was given by Dr. K. Inouye in 1913, in the well-known contribution "The Coal Resources of the World" published under the auspices of the XII International Geological Congress. The present account is in the main a condensation of the elaborate thesis mentioned above, without any essential modification, especially concerning the coal fields of Kyushu, Honshu, Taiwan and Ishikari in Hokkaido. Only some additions were made for the rest of the coal fields in Hokkaido and South Saghalien, having been based chiefly upon the facts collected from various official publications, and also from personal information with regard to the field explorations carried on in recent years by local governments and mining companies.

The classification of coal used here is that adopted by the International Geological Congress of 1913, in "The Coal Resources of the World." Statistical data were taken mostly from the Statistical Report of the Department of Agriculture and Commerce (abolished in 1925), and of the Department of Commerce and Industry (established in 1925).

Geological and Geographical Distribution

Geologically speaking, Japanese coal exists in several formations ranging from the Palaeozoic to the Tertiary.

PALAEOZOIC COAL.—In insular Japan, the existence of coal in the Palaeozoic rocks is rather rare. Anthracite recently found in the Kwanto Mountains and the Mino Province is of doubtful economic value, but of scientific interest.

In Chosen, anthracite is found in the Heian System from the Permo-Carboniferous to the Permo-triassic in age, and also in the Lower Daido Series of the Liassic. The former is far more important than the latter, being approximately of the same age as some anthracites in Manchuria and North China. The most important coal field of the Permo-carboniferous and Permian age is that which is usually known as the Heijo Coal field in South Heian-do, where, since 1911 anthracite and semi-anthracite are being worked. The Heian rocks in the Kaisen district in S. Heian-do, the Kogen and Bunsen districts in S. Kankyo-do, the Koryo, Seizen and Sanchoku coal fields in Kogen-do all contain similar coal.

MESOZOIC COAL.—Mesozoic coal is distributed in Japan and Chosen, the area where it is found being usually quite limited. The coal mostly ranges from semi-anthracite to bituminous coal in quality. Triassic anthracite of inferior quality occurs at Nariwa in Chugoku in Honshu. Rhaetic anthracite and semi-anthracite have been worked at the Omine and Tsubuta Coal fields in Chugoku. Jurassic coal is found in the coal fields of Umezako in Tamba, Maizuru in Tango, Ono in Echizen, as well as in Kaga and Etchu in Honshu but all in minor quantities.

In Chosen, there are many coal fields, small in extent, carrying anthracite which resemble the Jurassic, some, decidedly the Liassic, and others the Upper Jurassic. These are found at Waikan and Monkei in N. Keisho-do, Sangaipo near Kenjiho in Kokaido, Taimin and Kimpo in Keiki-do and Josen in S. Chusei-do.

TERTIARY COAL.—The Tertiary coal is found widely throughout Japan, and is the most important, as the bulk of Japanese coal production comes from the Tertiary rocks. They range from bituminous coal to lignite in quality.

PALAEOGENE COAL.—The important coal in Northwestern Kyushu, namely that found at Chikuho, Miike, Karatsu and Takashima, etc., as well as that in the Amakusa Island, has recently been proven to be of the Eocene age, while that of the Sasebo fields is of the Oligocene. They are extensively mined, and belong to the low-grade bituminous coal of good quality, some of which cakes well so as to be suitable for metallurgical purposes. In the Island of Amakusa and in a certain part of the Chikuho coal field, bituminous coal has been affected by basalt and has assumed a semi-anthracitic character, or even has been altered into natural coke, of fixed carbon often exceeding 70 per cent of its contents. Coal in the Kumabo field in Kii, Honshu, also shows an anthracitic tendency, and might be of the Palaeogene age just as the Amakusa coal, although it is now commonly accepted as to be of the Miocene.

The lower coal-bearing series of Hokkaido and South Saghalien have been compared with the Kenai series of Alaska and the coal-bearing series of North Saghalien, which are of the Palaeogene age. The coal in these series ranges mostly from the low-grade bituminous coal to black lignite, caking or non-caking. The Northwest Coastal Field of South Saghalien is traversed by andesite and other basic dykes which have often driven off the volatile matter of coal to some extent and have given them a high grade bituminous character.

In Chosen, the Palaeogene coal occurs in several districts such as the Kwainei, Meisen-Kisshu, Anshu, Eitoku and Geijitsu coal fields. It is mostly low grade bituminous coal, slightly caking or non-caking, some being black lignite.

MIOCENE COAL.—The coal-bearing formation that forms the Joban field, the largest one in Honshu, is considered to be of the lower Miocene or Oligocene according to authors, the coal being black lignite which does not cake. The Miocene coal from the Ube and Onoda Fields is also black lignite, while that from Aburato in Uzen is the bituminous coal with fair caking properties, but with a great quantity of ash.

Extensive coal fields in the northern part of Taiwan produce a low-grade caking bituminous coal, which is also believed to be of the Miocene age. Similar coal is found in the Island of Yaegakijima in Ryukyu.

Important Miocene coal fields are also found in South Saghalien' namely, the Northern or Poronai Fields, the East Coast Fields and the Tokompo or Naiporo Fields, the coal measures of which are commonly referred to as "the Upper Coal-bearing Series," containing black lignite similar to the Joban coal.

PLIOCENE LIGNITE.—A lignite bed is widely found in Central and Northeastern Honshu. The lignite field extending over Mino and Owari, known as the Nobi field, is the most important. More minor deposits are found in the Kitagami-gawa valley, the hilly regions near Sendai, in the Mogami Basin near Yamagata, the foot-hills of the Kwanto Mountains and in the Provinces of Ise, Iga and Omi. They are worked on a small scale for local consumption only.

Estimates of Reserves

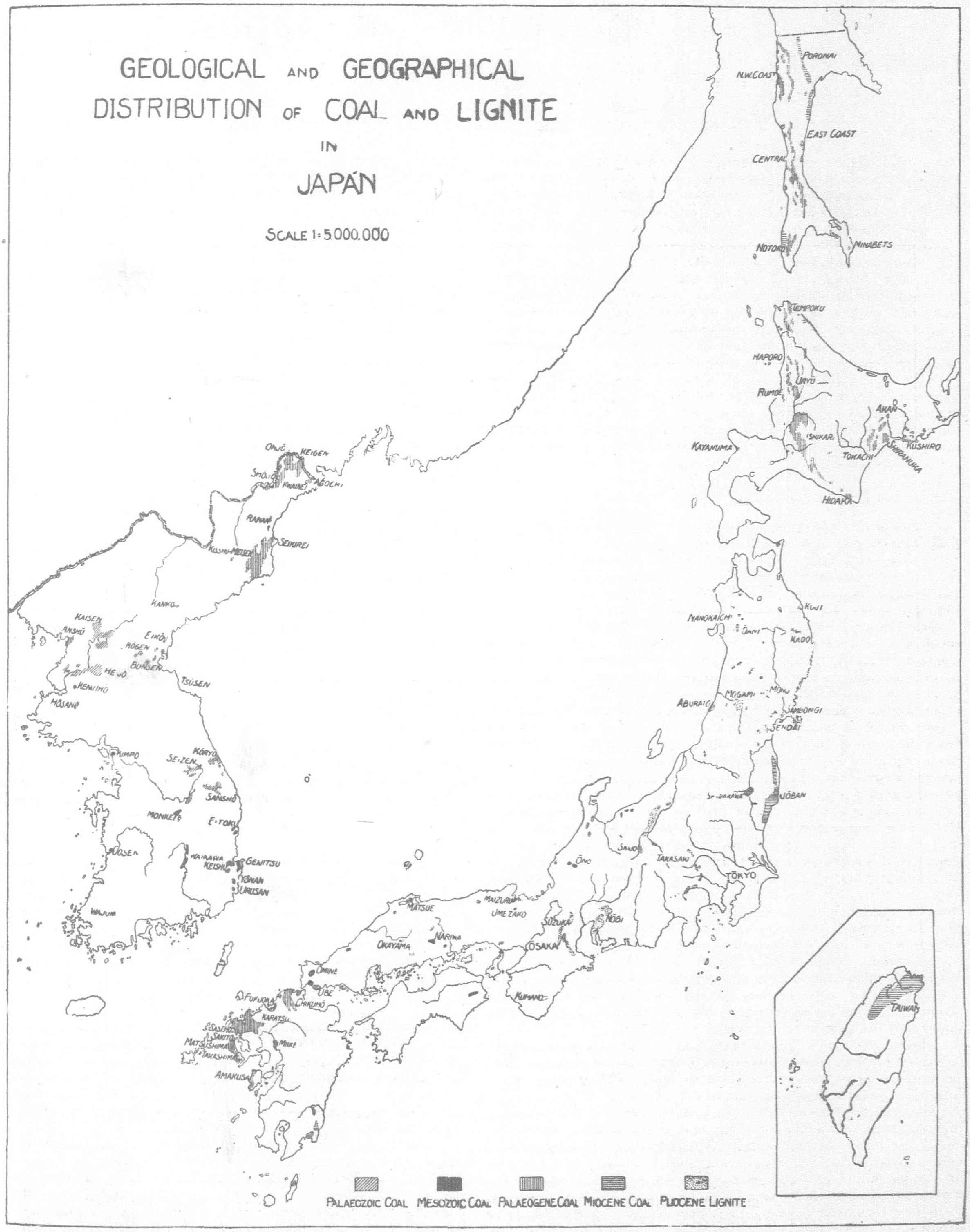
The estimates of coal and lignite reserves of Japan are shown in the affixed Table, where the probable reserves include those to a depth of 4,000 ft. Owing to the scarcity of available data, the coal reserves in Karafuto (South Saghalien) and Hokkaido, except those of Ishikari and Kayanuma, were calculated in a different way, taking those above the sea level for actual reserves, and those between the sea level and a depth of 1,000 ft. or 300 m. for probable reserves.

Mining Development

KARAFUTO.—Although the coal reserves here are rather considerable, yet their development was not begun until quite recently, because most of them are not easily accessible, and are situated far away from industrial centers. At Kawakami a mine was opened for the first time in 1912, and those at Nayoro, Shiretoko, Esutoro and other places have been successively mined, but their output was limited to meet only a small local demand.

HOKKAIDO.—The Ishikari coal field in the central part of the island, having a large reserve of coal fair in quality, has been developed some fifty-five years. There have been opend many mines, among which Yubari, Bibai, Sunagawa, Shin-yubari, Sorachi, Mojiri, Horonai, Mayaji, Ashibetsu, Ikushunbetsu and Honbetsu are important. As most of these mines have been opened more recently than in Kyushu, they are generally worked by the modern method

(*Continued on page 425.*)



GEOLOGICAL AND GEOGRAPHICAL DISTRIBUTION OF COAL AND LIGNITE IN JAPAN

SCALE 1: 5.000.000

COAL RESOURCES OF JAPAN

Coal field	Class of Coal	Age	Thickness of Coal-Seams (Meter)	Actual Reserve (Estimated in 1912)		Probable Reserve (Estimated in 1912)		Total Reserve (Estimated in 1912) (Metric Tons)	Aggregate Production 1913-1927 (Metric Tons)	Total Reserve less Aggregate Production (Metric Tons)	Authority
				Area (sq. km.)	Metric Tons	Area (sq. km.)	Metric Tons				
(Palaeozoic)					(8,600,000)		(36,900,000)	(45,500,000)	(3,172,654)	(42,327,346)	
Heijo (Chosen)	A. B.	Permo-carnoniferous	1.2–6	2	8,600,000	12.5	36,900,000	45,500,000	3,172,654	42,327,346	Inouye
(Mesozoic)					(1,000,000)		(31,000,000)	(32,000,000)	(1,510,567)	(30,489,433)	
Omine	A^2	Rhaetic	0.9–3.6	0.4	1,000,000	6.0	18,000,000	19,000,000	1,500,431	17,499,569	,,
Others	A–C	Rhaetic-Jurassic	0.9–4.0	—	—	3.6	13,000,000	13,000,000	10,136	12,989,864	,,
(Tertiary)					(1,305,821,000)		(7,344,547,000)	(8,650,368,000)	(447,438,661)	(8,202,929,339)	
Karafuto					161,110,000		1,425,000,000	1,586,110,000	2,011,736	1,584,098,264	
N. W. Coast	B–C	Palaeogene	1.0–14.0	—	—	86.5	648,590,000	648,590,000	—	648,590,000	Watanabe
Northern	D	Miocene	2.0–6.0	—	12,570,000	19.0	61,590,000	74,160,000	—	74,160,000	Kano
East Coast	D_1	,,	1.5–5.0	—	—	25.4	121,940,000	121,940,000	—	121,940,000	Watanabe
Central	C	Palaeogene	1.0–10.0	—	104,300,000	—	409,270,000	513,570,000	2,011,736	739,408,264	Kano, Otsuki, Watanabe
Southern	C	,,	3.0–10.0	—	44,240,000	29.0	183,610,000	227,850,000			Inouye, Kano
Hokkaido					530,211,000		2,633,547,000	3,163,758,000	63,274,006	3,100,483,994	
Ishikari	C	Palaeogene	1.8–51.5	25.3	307,600,000	271.5	1,791,500,000	2,099,100,000	59,109,164	2,039,990,836	Inouye
Tempoku	C–D_1	,,	2.0–11.0	—	17,670,000	—	270,690,000	288,360,000	909	288,359,091	Inouye, Watanabe
Haporo	C–D_1	,,	30.	—	8,220,000	—	28,980,000	37,200,000	—	37,200,000	Uyemura, Watanabe
Opiraushpetsu	C	,,	1.0–10.0	—	20,082,000	—	76,982,000	97,064,000	—	97,064,000	Rokkaku, Watanabe
Rumoi	C	,,	1.5–3.0	—	11,934,000	—	27,713,000	39,647,000	325,954	39,321,046	Uyemura, Iizuka
Uryu	C	,,	—	—	38,707,000	15.5	151,000,000	189,707,000	—	189,707,000	Inouye, Yamane
Kushiro	C	,,	0.5–3.0	19.5	32,380,000	—	105,210,000	137,590,000	3,544,403	297,785,597	Kadokura, Iizuka, Suzuki
Akan	C	,,	0.6–4.3	—	57,270,000	—	84,630,000	141,900,000			Kadokura, Watanabe
Shiranuka	C	,,	—	—	9,720,000	—	12,120,000	21,840,000			Watanabe
Oraporo	C	,,	1.0–5.0	—	19,368,000	—	43,122,000	62,490,000	7,841	62,482,159	Oinouye, Kobayashi
Kayanuma	C–D_1	,,	1.8–7.0	—	7,260,000	—	41,600,000	48,860,000	285,735	48,574,265	Inouye
Honshu					69,500,000		512,000,000	581,500,000	66,917,331	514,582,669	
Nanokaichi	A_1–B_2	Miocene	1.8–2.7	—	1,000,000	—	19,500,000	20,500,000	371,571	20,128,429	Inouye
Aburato	C	,,	0.6–1.8	—	1,000,000	—	14,000,000	15,000,000	306,431	14,693,569	,,
Joban	D_1	,,	0.6–4.2	14.0	43,500,000	122.0	306,000,000	349,500,000	44,885,515	304,614,485	,,
Ube	D_1	,,	0.9–3.6	4.4	10,000,000	37.5	85,500,000	95,500,000	19,000,000	76,500,000	,,
Mogami	D_2	Pliocene	0.8–0.9	—	—	17.0	20,000,000	20,000,000	204,389	19,795,611	,,
Nobi	D_2	Pliocene-Pleistocene	0.8–1.2	11.0	13,000,000	26.0	30,000,000	43,000,000	1,642,540	41,357,460	,,
Sendai, Suzuka, etc. ..	D_2	Pliocene	0.5–1.2	0.6	1,000,000	37.4	37,000,000	38,000,000	506,885	37,493,115	,,
Kyushu					545,000,000		2,389,000,000	2,934,000,000	299,022,864	2,634,977,136	
Chikuho	C	Eocene	1.4–11.1	71.2	405,500,000	229.3	1,255,000,000	1,660,500,000	213,246,724	1,447,253,276	,,
Miike	C	,,	3.0–5.5	10.0	60,000,000	130.0	700,000,000	760,000,000	31,340,309	728,659,691	,,
Karatsu	C	,,	0.9–4.2	8.0	17,000,000	53.0	112,000,000	129,000,000	28,163,521	100,836,479	,,
Sasebo	C	Oligocene	0.5–2.7	—	—	110.0	90,000,000	90,000,000	24,895,603	338,104,397	,,
Sakito	C	Eocene	4.5–4.9	2.5	16,000,000	6.5	40,000,000	56,000,000			,,
Matsushima	C	,,	3.6–4.2	2.0	10,000,000	5.0	28,000,000	38,000,000			,,
Takashima	C	,,	4.5–15.2	2.5	33,000,000	11.0	146,000,000	179,000,000			,,
Amakusa	A_2–B_1	,,	1.2–1.8	1.4	3,500,000	8.0	15,000,000	18,500,000	749,295	17,750,705	,,
Yaeyama	C	Miocene	2.0–4.0	—	—	3.5	3,000,000	3,000,000	627,412	2,372,588	,,
Taiwan	C	Micene	1.0–4.0	—	—	237.0	385,000,000	385,000,000	16,212,724	368,787,276	,,
Grand Total					1,315,421,000		7,412,447,000	8,727,868,000	452,121,882	8,275,746,118	

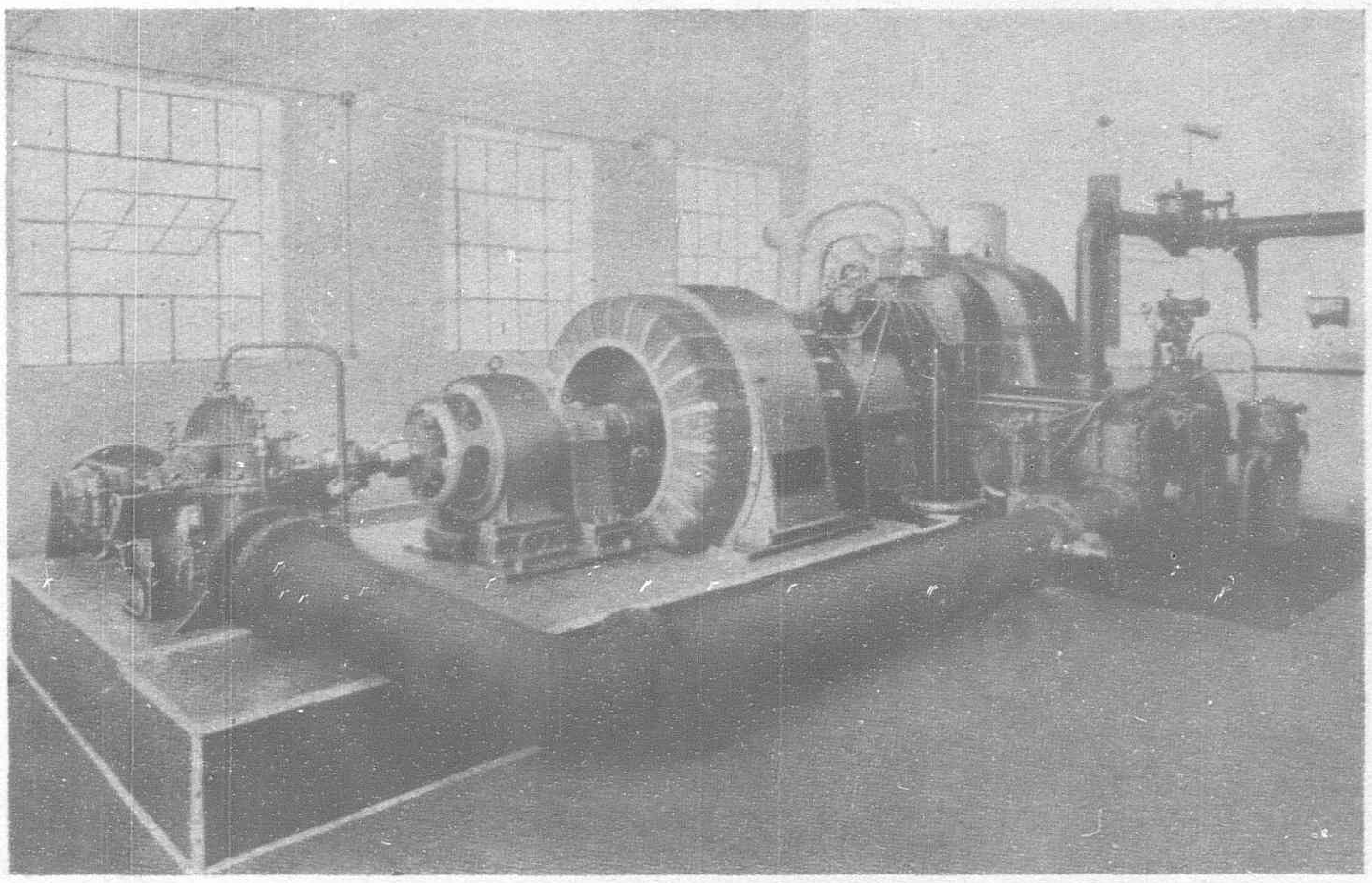
Total Reserve of Coal.. .. .. about 8,276,000,000 metric tons

of which

Anthracite and Semi-Anthracite	.. about	113,000,000
Bituminous Coal and Black Lignite	.. ,,	8,063,000,000
Lignite	,,	100,000,000

Self-Contained Generating Plant

Installations for Chinese Mills



A 1,250 kw. Metrovick Self-Contained Turbo Alternator Set in the Hua Feng Cotton Mill, Woosung

Among the many installations which have been made of the self-contained turbo alternator sets recently developed by the M.-V. Company the set shown in the accompanying illustration is of special interest as the first to be put into commission in the Far East.

The installation is a 1,250 kw. set in the Hua Feng Cotton Mill of the Japan-China Spinning and Weaving Company at Woosung, near Shanghai. It replaces two old 400 kw. turbo alternator sets and is part of a complete re-equipment of power plant, new boilers having been installed at the same time.

The new turbo alternator set is mounted at the floor level of the old condenser basement, a convenient arrangement made possible by the fact that sets of this type require no basement themselves nor even foundations as ordinarily understood. It will be noted from the illustration that in this case the set is mounted on a low concrete plinth which is faced with tiles giving a particularly neat finish to the compact arrangement. The illustration shows also how the arrangement of the turbine and condenser eliminates the need for a basement. All the auxiliaries of the set are direct driven from the set itself, and thus require no separate control or external power supply.

The turbine is a high-pressure machine designed for operation at 5,000 r.p.m. with steam at 300 lbs. per sq. inch gauge pressure at the turbine stop valve, superheated to 680° F. The generator is gear driven at 1,200 r.p.m. and generates at 600 volts, 3-phase, 60 cycles, this being the supply required for the existing motors for the mill drive. The equipment includes an automatic voltage regulator mounted on the generator control panel.

The installation was completed and put into commission in February of last year. A report recently received by the Metropolitan-Vickers Electrical Co. from Mr. F. Ohnishi, Engineer-in-Chief to the Japan-China Spinning & Weaving Company, states that the set has given complete satisfaction in continuous operation since its installation, no trouble having been experienced with any part of the equipment and the guarantees with regard to steam consumption having been satisfactorily met.

Another set of this type has recently been installed in China for the Loong Chang Paper Mill. This equipment is a 1,000 kw. set, similar in general arrangement to the set above described except that it is arranged to pass out steam required for heating the callenders of paper making machines in the mill. This feature, which can readily be provided with sets of this type, is one which effects considerable economy in the power system, since the steam required for process work can at very low extra cost be used to give energy in the early stages of the turbine. In the Loong Chang installation the turbine is designed to operate with steam at 160 lb. per sq. inch pressure and 250° F. superheat, and to pass out 9,000 lb. of steam per hour at 40 lb. per sq. inch pressure while maintaining full output from the set. The set is also arranged to pass out steam amounting to 11,500 lb. per hour, with an output of 800 kw. from the generator, for short periods daily when this extra process steam is required.

The continued success of the Metropolitan-Vickers self-contained turbo generator sets is shown by the steadily increasing number supplied. The number of sets installed and on order has now risen to about 100 with a total capacity of about 100,000 kw. Of these sets twenty-three are for the British Navy, four for the Japanese Navy, two for the Chilean Navy, three for the Singapore Naval Base and the remainder for a variety of municipal and industrial undertakings, including ten sets for textile mills. The sets are manufactured in sizes giving a range of capacities from 200 kw. to 6,000 kw. and are notable for their low installation cost, high efficiency and simplicity of operation.

New Lighthouses on Kwantung Coast

The Kwantung Government has laid out the sum of Y36,000 odd to erect a few lighthouses, signalling staffs, and other aids to navigation in the current fiscal year.

Acting upon the recommendations by the Marine Office, Dairen, a new lighthouse is to be set up on the top of Boto Island, 265 ft. above the sea level at eight miles southwest of Dairen, as the badly wanted guide to the shipping having access to the port of Dairen.

Another lighthouse is to be built on the solitary island of Shuangtotzu, 200 ft. above the sea level, half way between Pulantien and Kulungtotzu Island, and a third on Hsiaolungchuantao Island, 15 miles north of the southwestern corner of Laotiehshan Mountain (south of Port Arthur) that serves as the only guide to the shipping turning in the direction of the port of Dairen.

In each case, the new lighthouse is to be 7.70 meters high, of cylindrical shape, built in reinforced concrete, and lighted by acetylene gas of 300 candle power. It is of revolving pattern, with the range of 15 miles.

Next, the lighthouse on Haiyangtao Island (the whale fishing ground) is located at the easternmost edge of Kwantung Leased Territory and 13 miles east of the Elliot Group, the only guide for the shipping from Chosen coasts making for Dairen and Port Arthur. However, it is now an obsolete affair lighted by kerosene. Further, because of its unsuited location, the light has been noticed to go out at times. The old lighthouse is to be replaced with a new one exactly on the same lines as above described.

In addition, the beacon on Yinchiao, eight miles from Sanshantao Island at the entrance to the Dairen Bay acquitting itself poorly, it is to be supplanted with a new one in reinforced concrete.

As to the signalling staff Laotiehshan Mountain near Port Arthur, it is now 18 years old, and is found badly shaky, apt to be felled at a violent shock. It is to be replaced with a joint of Oregon pine staffs, the lower staff, 0.25 meters in diameter at the base and 11.5 meters tall, and the upper staff over 20 meters high.

About Pulantien junk port, the coasts are studded with reefs or sunken rocks, forming a menace to navigation. On this account four aids to navigation are to be installed about Shuangtatzu and Totzutao Island.

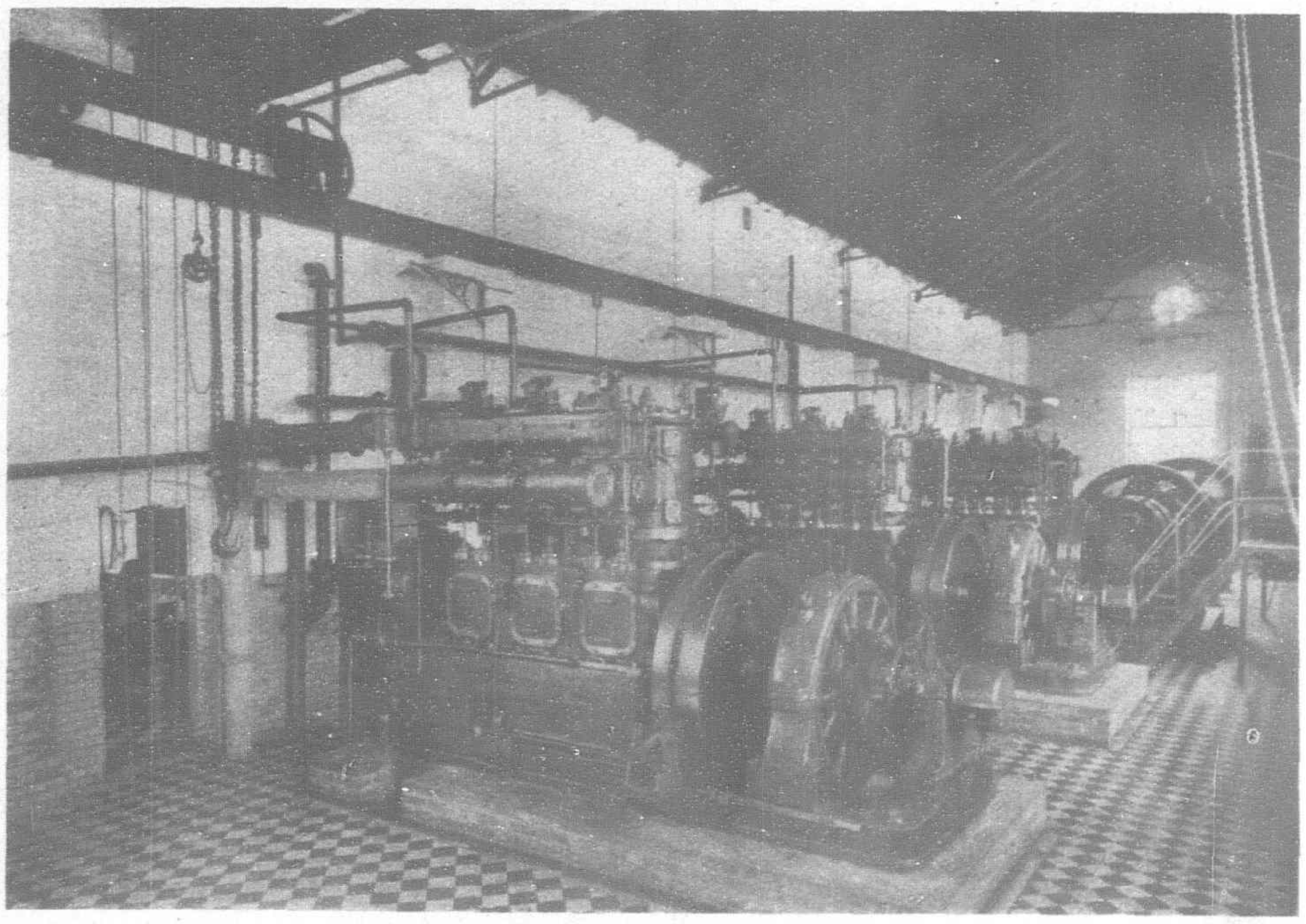
All the work is to be finished by next autumn, and they will be welcomed as a boon to the mariners.

Peiping's Electricity Supply

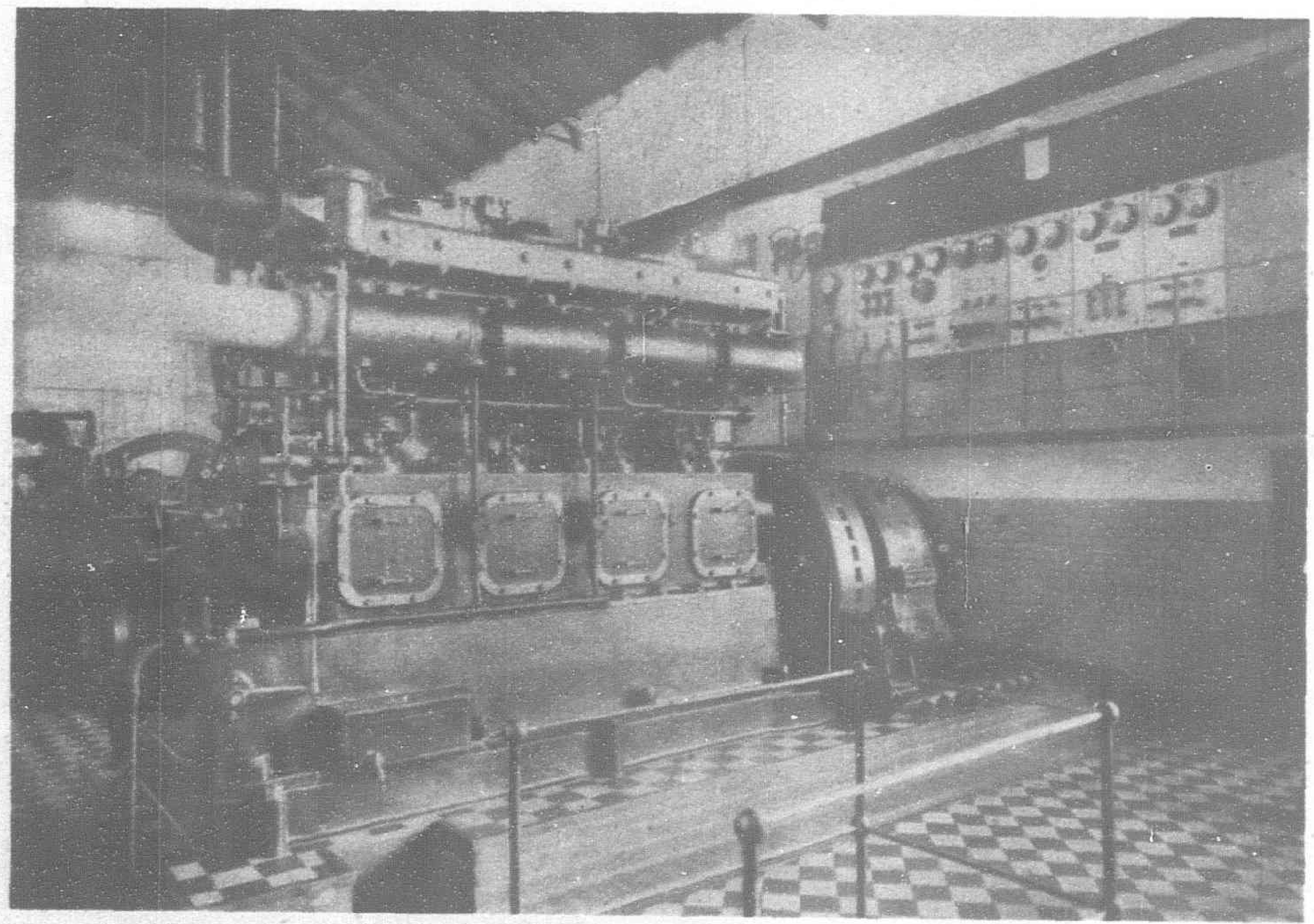
Special Problem is Presented by Conditions in Northern Capital

The Peking Electric Co. was founded shortly after the Boxer trouble by the old firm of Arnhold, Karberg & Co., with the object to provide the Legation Quarter with an independent source of electricity.

The Company started its activities with three single cylinder horizontal 80 h.p. "Koerting" suction gas engines using Shansi and Honan anthracite. The choice for this kind of machinery was justified in so far as economy of fuel is concerned for a station of small size in this part of the country. It is by far the most economical kind of plant to run when good anthracite is to be obtained at about $11.00 per ton. However other difficulties more than outweighed these advantages. The main difficulty lay in finding skilled Chinese labor and as there are practically no plants in North China operating coal gas motors, every man of the Chinese technical staff had to be trained for every kind of work attached to a plant of this description. In this respect the Company was also nnfortunate as the different foreign engineers that were in charge, one after the other proved incompetent to carry on with the result that for a number of years the company struggled on, meeting the demand with a very uncertain supply and it was an even chance whether the lights were off or on. The only other electric station in Peking being in practically the same unsatisfactory state, consumers had no alternative but to grin and hope for the best.



General view through Engine Room



Showing the 4-Cylinder 250 h.p. Browett Lindley Suction Gas Engine using anthracite coal

As is so often the case the plant very soon was too small to cope with the increasing demand and in 1910 a 150 h.p. Koerting gas engine was ordered from Germany. With that engine the manufacturers sent out one of their engineers and from then conditions improved.

The generated electricity being direct current (3 wire system, 2 by 220 volts) the company's radius of activity has been naturally limited, which was to be regretted as with the company's service becoming more and more reliable, the demand was far beyond its possibilities.

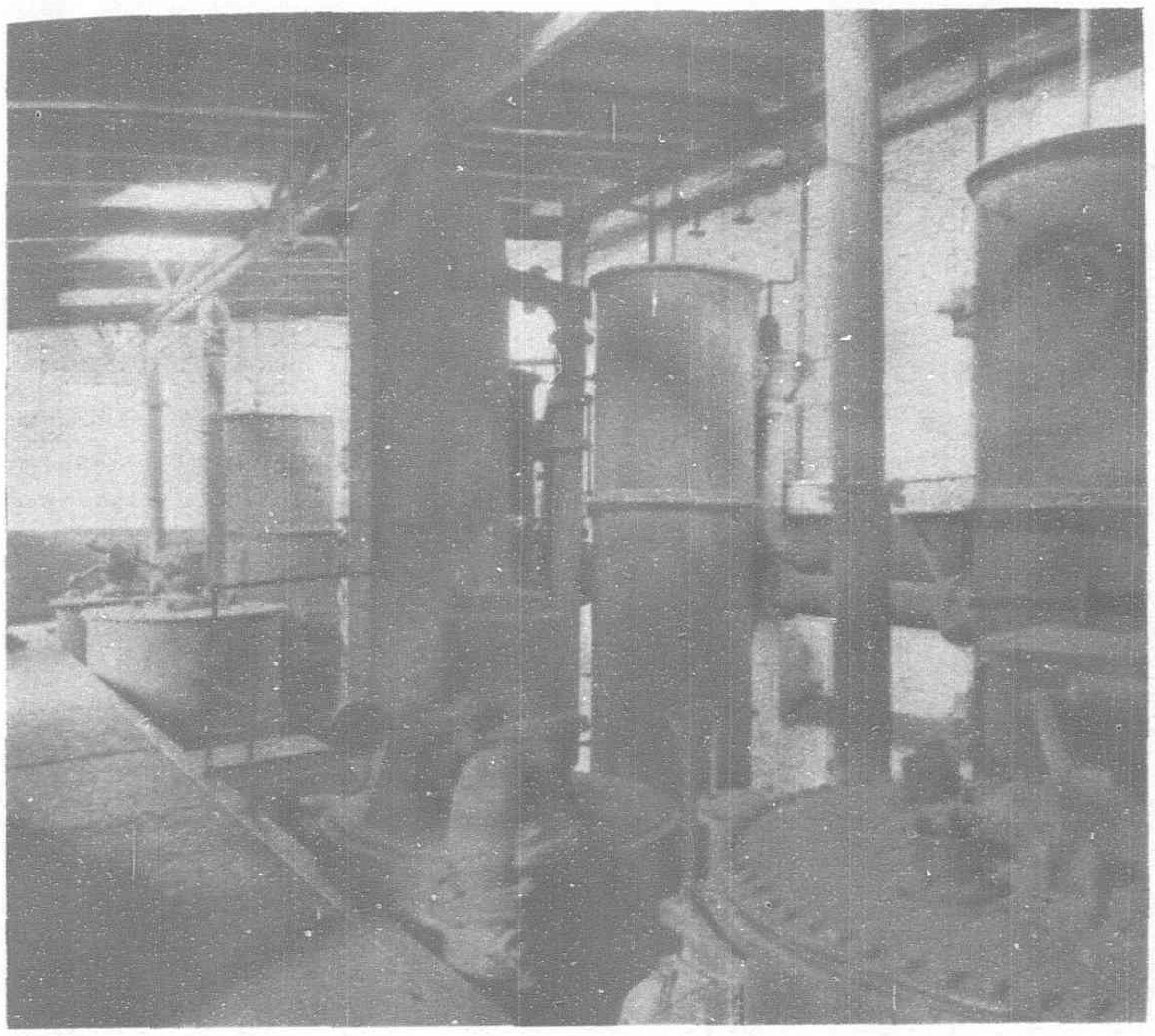
In 1913 the Company ordered a 2 cylinder 250 h.p. Koerting gas engine. Just before the outbreak of the Great War construction of this engine was completed and it was shipped to China, but on its way the German ship was seized by British warships and the cargo confiscated. The Company's position was now bad indeed. To make matters worse the two German engineers who were in charge of the plant were ordered to Tsingtao and the Station for a time was left in charge of the Chinese staff. Messrs Arnhold, Karberg & Co., who were still the owners of the plant, transferred two of their engineers to Peking to take charge and these two men with no one to guide them or give them information had a difficult time before they became acquainted with the intricacies of the plant.

And so the Company struggled on in the best way it could during the years of the War with engines too small and overloaded, unable to buy suitable machinery for a constantly increasing demand.

As soon as the Armistice was declared the Company ordered from England a twin cylinder horizontal 250 h.p. gas engine and this engine was delivered almost a year after the promised time. From the first day that this engine was tried out it developed many defects undoubtedly due to the disorganized state of the technical industry at that time. The engine would not take anything like its rated capacity ; it was noisy, ran irregularly and produced a flickering light when not running with other machinery in parallel.

In 1923 the Company ordered a 4 cylinder vertical 250 h.p. Browett Lindley gas engine and in 1927 two 3 cylinder vertical 170 h.p. gas engines to replace the three originally installed 80 h.p. Koerting engines. These engines gave every satisfaction and could be relied upon to stand up under any reasonable load.

Although the former capital of China and one of its most important and largest cities, Peiping is very much lagging in electrical development. Carbon filament lamps are still in use here in many places. Modern conveniences for industrial and domestic purposes are comparatively unknown. Electrical cooking, heating and the hundreds of appliances that have been in existence for years in other places are sadly lacking. It must be said that the electric companies themselves are largely to blame for this. With the high unit price they charge ($0.24 per k.w. hour) it naturally follows that consumers are unwilling "to do it electrically." On the other hand the electric stations are reluctant to allow a much lower tariff as long as their power load factor is almost negligible.



Part of Producer House showing Producers and Coke Scrubbers

Coal Resources of Japan

(Continued from page 420).

of mining and are well equipped. Lately, the production is about 5,000,000 metric tons in a year, and the coal produced is mainly consumed in Tokyo and Northeastern Japan.

The Kushiro coal field, situated near the Kushiro port, is worked on a small scale through several mines. The coal is generally of thin seams and is of rather inferior quality, yet it is used for bunker, although limited in its amount.

The coal fields in Hokkaido, other than those of Ishikari and Kushiro, are not worked very much now, due, in part, to the high cost of transportation.

HONSHU.—The coal of the Joban fields is of an inferior quality, often being rich in ash and sulphur ; but, still, it is rather extensively mined, being favored by good railway connections with Tokyo and its vicinity, where a fairly large amount of coal is consumed. The total production from Uchigo, Iriyama, Isohara, Chiyoda, Yoshima and other mines reaches about 2,500,000 metric tons annually.

Although the Ube coal is also of inferior quality and limited in extent, it is actively mined even under the sea-bottom, as it is easily transported by sea to the industrial city of Osaka. The mines here are mostly on a small scale, and the total production is about 700,000 metric tons annually.

Lignite of the so-called Nobi plain, extending over the two provinces of Mino and Owari, is mined for the factories of porcelains which are special products of the district. Lignites of Takasaki, Mogami, Sendai and other districts are mined to meet local demands, but only for limited consumption.

Anthracites of Omine, Kumano and Nanokaichi are not extensively mined, as they are mostly fine and usually rich in sulphur and ash.

KYUSHU.—The coal fields in the northern part of Kyushu include those of Chikuho, Fukuoka, Karatsu, Sasebo, Sakito, Matsushima, Takashima, Miike and Amakusa. On account of good climate and accessibility to sea-ports, several mines were opened as early as 1870, and since then the coal fields have been so extensively developed that the establishment of an industrial center followed. Although the coal from here is bituminous and gives off a dense smoke while burning, it is quite extensively used for boilers, both land and marine, and is even exported to Oriental sea-ports. Important mines are those of Shin-nyu, Meiji, Onoura, Shakanoo, Namazuta, Futase, Tadakuma, Yamano, Shimoyamada, Hojo, Akaike, Kanada, Hokoku, Takawa, Kishima, Iwaya, Ochi, Yoshinotani, Matsushima, Takashima and Miike. Among others, the Miike and Takashima mines are of recent accommodation and the mining development has been extended over submarine bottom, far off from the shore.

The production from the Kyushu coal fields reaches about 15,000,000 metric tons in a year, and occupies about one-half of the total production from Japan.

TAIWAN.—The Taiwan coal field, situated at the northern extermity of the island, has been active since the island was transferred to Japanese control. In this island the coal production is more than the consumption, and is supplied to the vessels visiting the Keelung harbor near the mines, or even exported to Oriental seaports. The yearly output is now little short of 2,000,000 metric tons.

CHOSEN.—The anthracite of Heijo has been mined in the main for briquette-making, and recently its production is about 700,000 metric tons annually. Lignite in Kankyodo is being mined here and there, but in small quantities.

PRODUCTION, IMPORT AND EXPORT OF COAL IN JAPAN.

The production, import and export of coal (including lignite) of Japan in the last ten years is tabulated as follows, in metric tons.

	Production						
Year	*Japan proper*	*Taiwan*	*Karafuto*	*Chosen*	*Total*	*Import*	*Export*
1918	29,109,036	801,520	104,695	188,623	30,203,874	1,241,064	2,197,037
1919	32,683,333	1,086,520	135,427	219,554	34,124,834	1,256,758	2,000,697
1920	30,717,339	1,139,358	154,292	289,036	32,300,025	1,362,574	2,589,829
1921	27,512,448	1,029,410	115,255	310,590	28,967,703	1,218,090	2,843,923
1922	29,330,031	1,347,449	114,549	317,330	31,109,359	1,652,553	2,161,322
1923	30,712,268	1,445,000	166,986	380,378	32,704,632	2,319,107	2,076,113
1924	31,993,426	1,506,451	199,385	399,415	34,098,677	2,485,522	2,399,497
1925	33,620,037	1,704,581	250,615	624,238	36,199,471	2,224,960	3,424,843
1926	33,658,013	1,794,511	275,819	682,896	36,411,239	2,497,336	3,366,064
1927	35,923,523	1,857,257	357,046	709,578	38,847,404	3,300,335	2,751,706

Russia Buys Japanese Ships

Soviet Russia is buying not only rails but eight 500-ton freight steamers through the Mitsubishi Shoji Kaisha, according to the vernacular press. The ships will be used in carrying out the Soviet's five-year plan. The Japanese concern is said to be looking for suitable ships, none to be over 10 years old, to fill the Russian order.

Russia is working toward building up a Far Eastern mercantile marine to transport marine products from Kamchatka to foreign countries as well as to handle other cargoes now commonly transported by foreign ships. The eight ships are to be bought for a sum not to exceed Y.3,000,000 according to the report. Mitsubishi Shoji already is connected with the Soviet as it recently concluded an agreement with the Russian authorities for the importation of Soviet lumber.

It is explained that the purchase of the ships has nothing whatever to do with the Soviet's proposal that Japanese industry grant it a credit of Y.50,000,000. Russia now employs eight floating canneries off Kamchatka and charters more than 30 vessels to transport marine products and to handle other outward and inward cargoes. As its five-year plan has progressed, it has needed more ships and it figures that it will be cheaper to own than to charter.

Under the five-year plan, Russia will place 16 freighters of 57,000 tons in the Far Eastern service and its authorities presumably have placed other purchase orders abroad. Activity of Russian ships in Asiatic waters is being watched keenly.—*United Press.*

Overhead Line Work in Tientsin

With Special Comment on Earthing at Several Points, also on Concrete Poles as Used in China

By R. A. WILLIAMS

An interesting description of Overhead Electricity Lines in the City of Tientsin is set forth in a communication written by Mr. R. A. Williams, O.B.E., B.SC., A.M.I.E.E., A.M.I.Mech E., Electrical Engineer of the British Municipality of Tientsin. This is addressed to *The Electrical Times*, in which it recently appeared. Mr. Williams' communication follows :—

"The transmission of electricity here is carried out at 5,000 volts, three-phase, 50 cycles with the neutral at the generator firmly earthed without resistances. The transformation is by means of "pole" type transformers of 50 to 500 kw. delta on the high and star on the low side.

All transformers are absolutely the same in voltage characteristics and consequently they can all be operated in parallel ; with the exception of two 500 kw. Ferranti's, all transformers are of Johnson & Phillips' make and it is of interest to find that in 11 years of operation we have never had a failure attributable to any of our transformers.

Practically all of the transformers are provided with oil conservators which serve to keep out moisture during the wet season.

The L.t. distribution is carried out at 380/220 volt, 4-wire, with the neutral grounded not only at the substations but as far as possible at every house. I consider that it is fundamentally wrong to have one point of earthing as called for in some of the British regulations. The great merits of the overhead system are cheapness, simplicity, and reliability and all these are liable to be lost if relays, ammeters, oil switches, etc. are added ; every joint is a potential source of trouble and should be eliminated as far as possible.

We find that we have gradually got rid of everything superfluous, until the substation of up to 200 kw. is of ultimate simplicity, a three-phase transformer equipped with a maximum indicating dial thermometer (which instruments do not appear to be obtainable in Great Britain) and a h.t. and a l.t. fuse switch. The h.t. and l.t. connections are made with "Ancalite" or similar cables in iron pipes which help to protect against surges ; the above is all that is required, it is the simplest, cheapest and most reliable.

All house services are by means of one 600 meg. v.i.r. cable and one *bare* neutral wire. No insulation or any break is allowed at any point in the bare neutral wire which is again "grounded" at nearly every house.

In my home all appliances are connected by a wall plug of my own design and make (see Figure 4) which automatically "earths" the appliance as soon as it is plugged in and before the live phase is connected ; this plug is such that it is impossible for little fingers to touch the live terminals ; a sketch of this plug is enclosed.

The whole of the distribution lines are carried on concrete poles and from many years' experience of both wood and concrete poles, I would say definitely that concrete is cheaper in the long run, owing to the lower depreciation, lower costs of repairs, etc., and furthermore they have a better appearance than wood, which is a very important point in a residential district. It would appear that concrete poles should be used more and more in Great Britain for the reason that the cement and steel are home products, whilst wood poles are practically all imported.

The drawing enclosed (see Figure 3) will give a better idea than any description of the system used for our distribution lines.

It will be noticed that the h.t. lines are mounted on a light steel bracket above the pole with a short earthed iron bracket to "ground" the cable in case of a break.

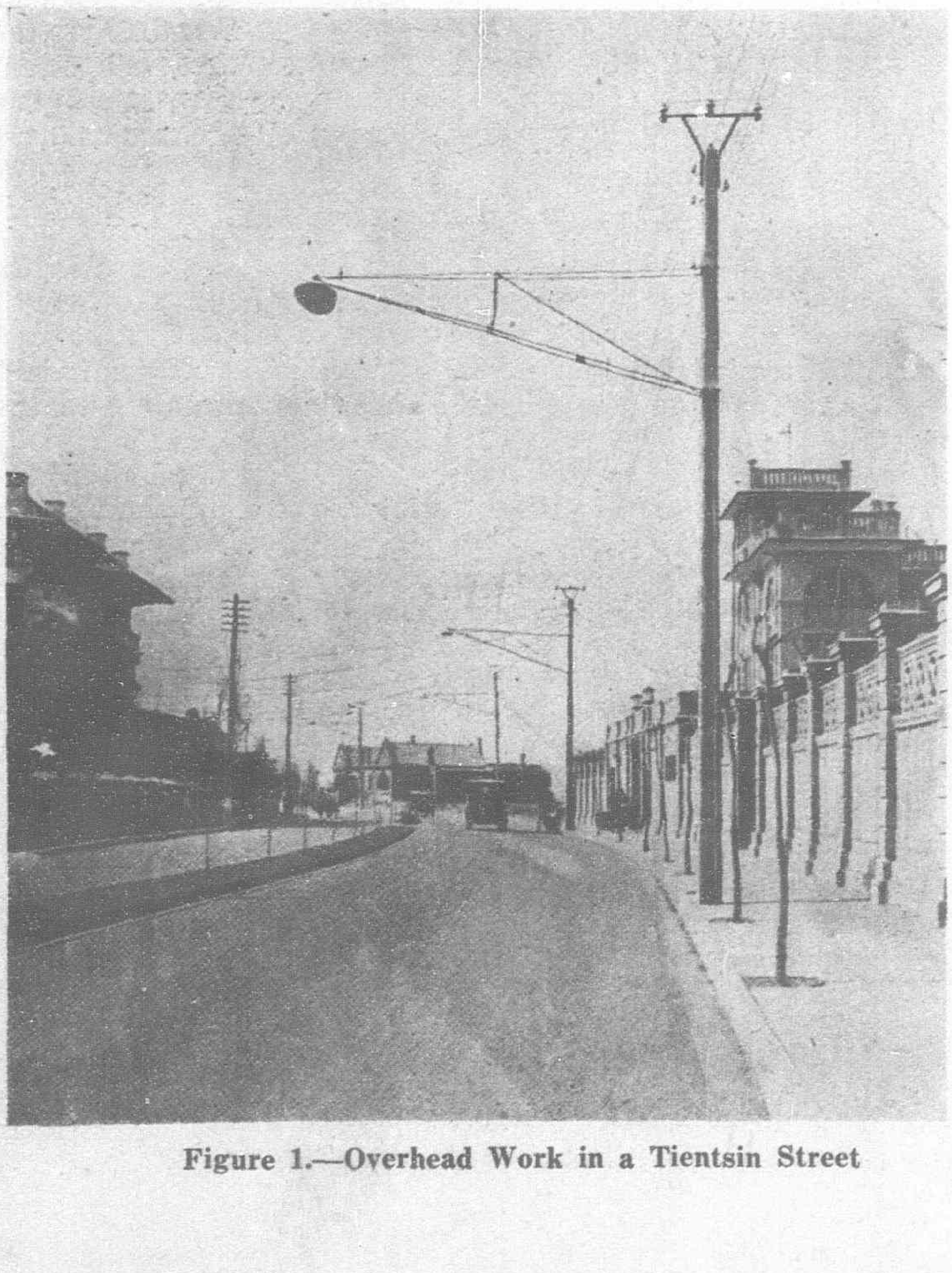


Figure 1.—Overhead Work in a Tientsin Street

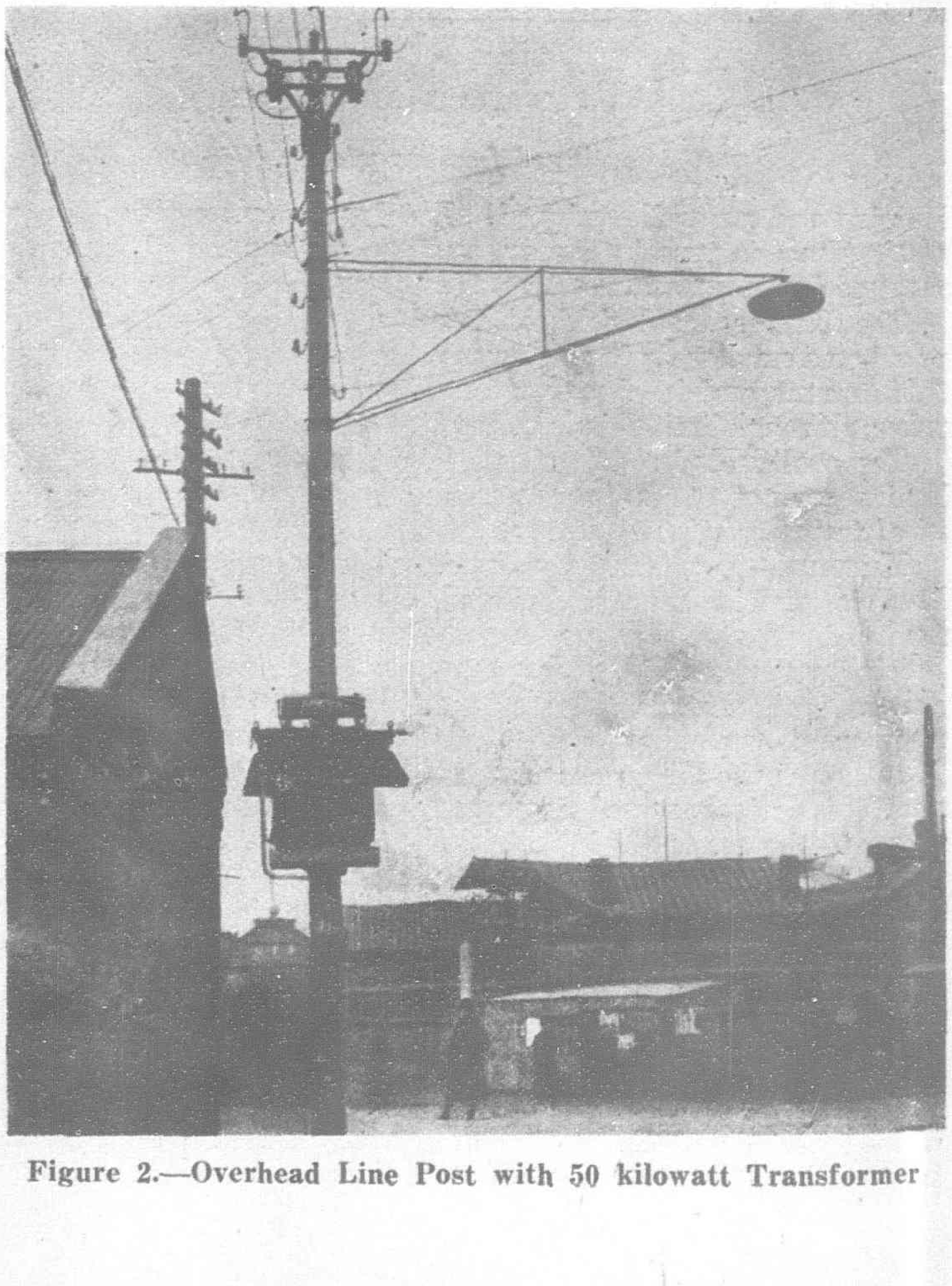


Figure 2.—Overhead Line Post with 50 kilowatt Transformer

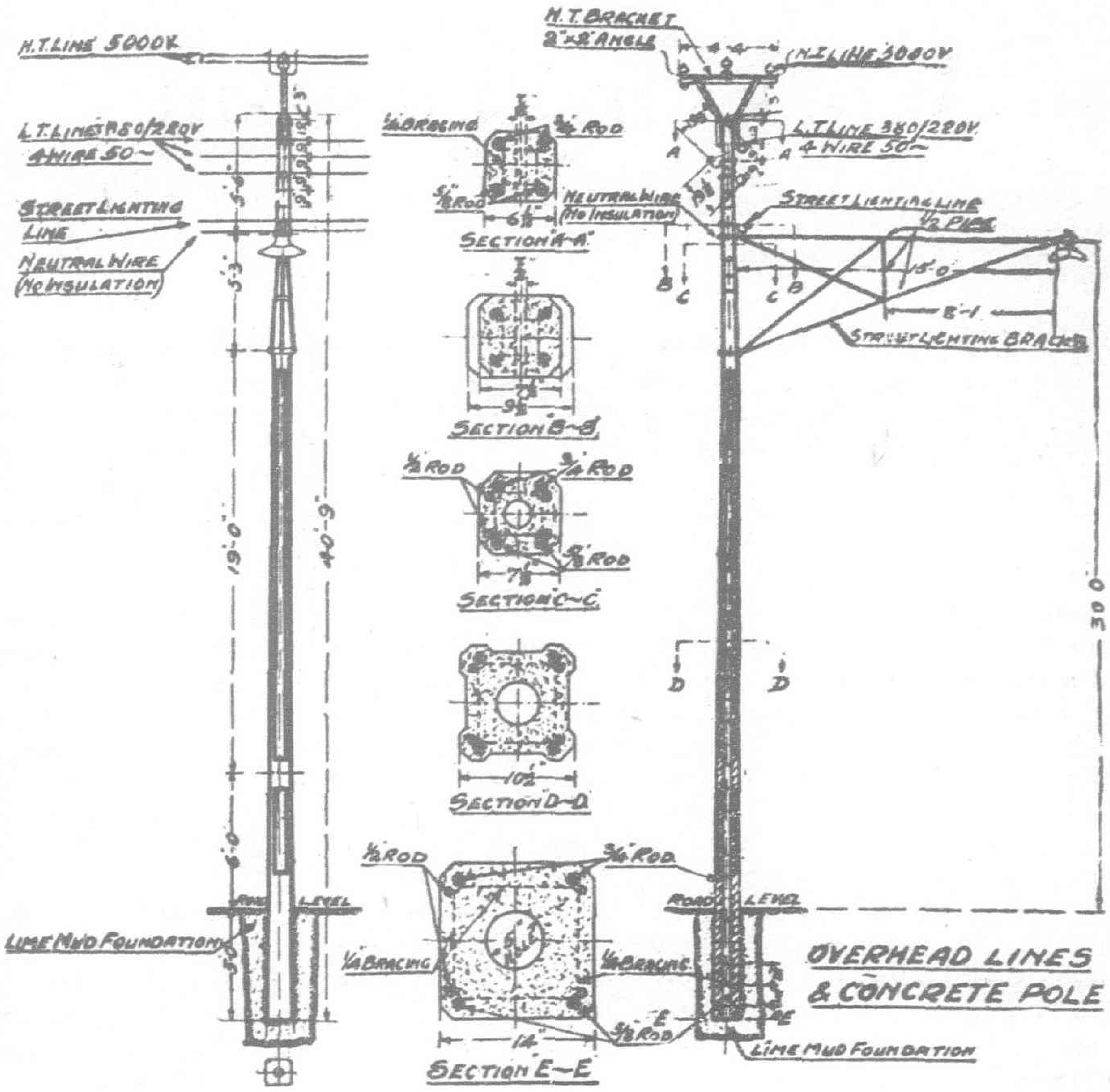


Figure 3.—Details of the type of Concrete Pole used at Tientsin

The addition of elaborate and unsightly nets underneath electric wires is absolutely unnecessary and in fact adds to the danger of workmen ; in eleven years I have only known one occasion when a h.t. line has come down and that was due to a large Chinese cracker alighting on the wire and breaking it, the wire was "grounded" by the short bracket and circuit opened by the oil switch in the station before the wire had touched the ground. The concrete poles in this district are spaced 150 to 180 feet apart in accordance with the requirements of street lighting.

The street lamps are mounted in all cases on brackets, which bring the light approximately above the center of the road and at a height of 30 feet over it.

It has been found that, in this dry and dusty climate, the best street lighting equipment is the bare open lamp, with a specially shaped shade, as the fine dust inevitably finds its way into glass enclosures. The street lighting system is all at 220 volts, which has many practical advantages over the series method.

The l.t. mains are placed at the top of the pole in a staggered position so as to allow of easier connection to house services, beneath this is the special street lighting main and at the bottom is the neutral wire, which is entirely unsupported by any insulators and is grounded to the water mains at every possible point.

House service wires are connected through a pole fuse by means of a 600 meg. v.i.r. wire to the live mains and a bare wire to the neutral ; the so-called "weatherproof" wire is no longer used as it becomes very ragged and unsightly in a few years. The final entrance to the house is made with a single lead-covered and a bare wire which go through a small hole which is afterwards filled in. The lead-covered wire was adopted to prevent the theft of electricity by sticking pins into the v.i.r. wires just before the entrance to the meter !

The service inside the house has one switch and fuse on the live wire only ; no disconnections are allowed in the neutral wire. It is proposed eventually to take out all the service switches and fuses and replace them by small loose-handle circuit brakers.

It is difficult to compare the capital costs of a distribution system in China with that in other countries as one is on a silver and the other on a gold basis, but it may be of interest to know that a usual house connection from the pole to the meter costs about £2 (not including the meter) whilst the average for the whole transmission, transformation and distribution system supplying 9,333 kw. is only about £4 per kilowatt. It would be impossible for an underground cable system to compare with these figures ; these low figures have not been obtained at the cost of high losses in transmission and distribution, which in our case are as low as 8.73 per cent for the year.

It should be noted that the climatic conditions in this part of the world are very severe ; the sun temperatures are as high as 145 degrees F., the minimum is 13 degrees F., with extreme dryness for nine months and excessive dampness for two months.

Mr. A. M. Sillar, of London, has been our valued consulting engineer since the inception of the Department.

The photographs herewith show the overhead distribution need not be the disfigurement that it is generally thought to be, and it is certainly the only way by which the suburban and rural population can be given a cheap and satisfactory supply of electricity.

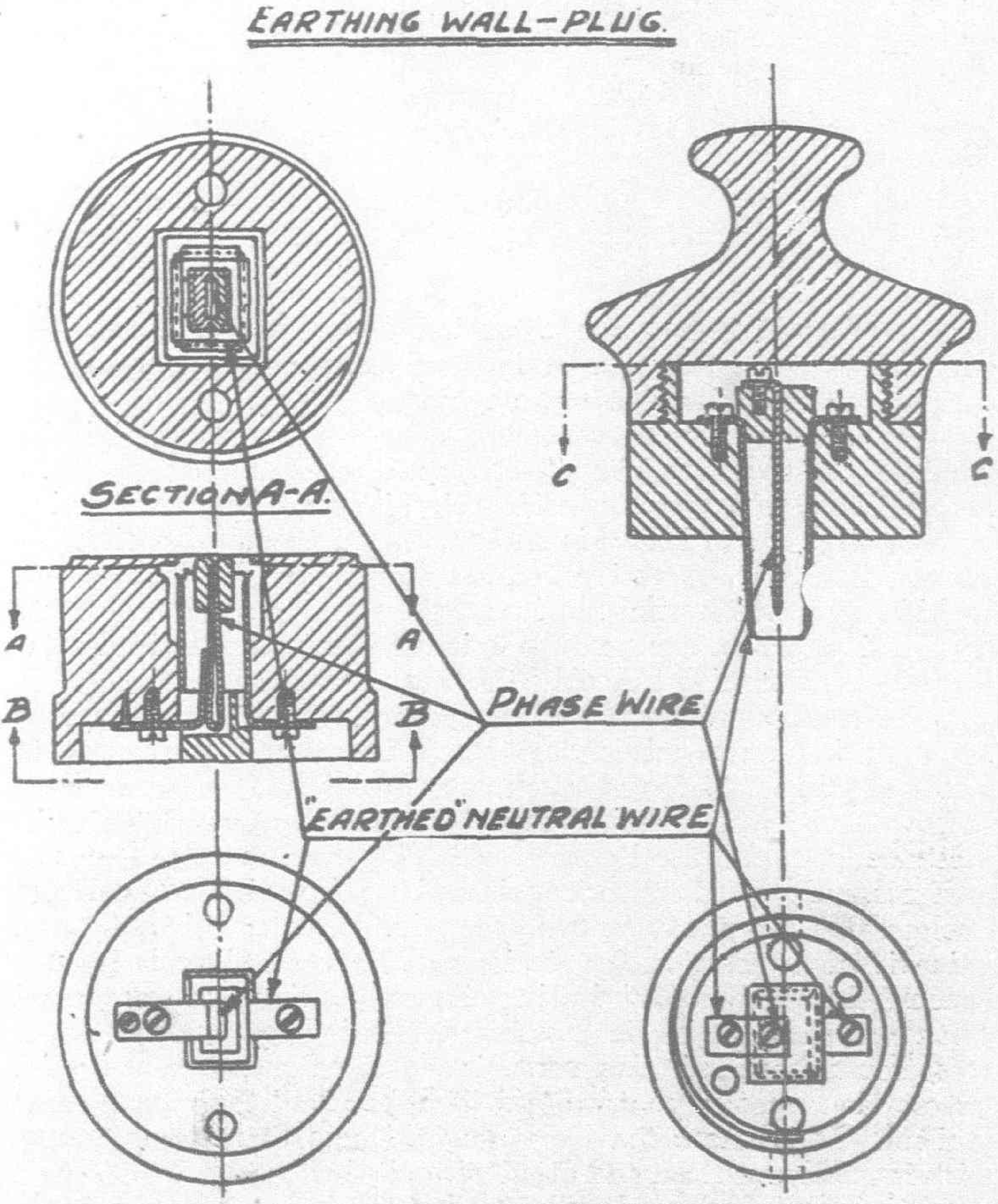
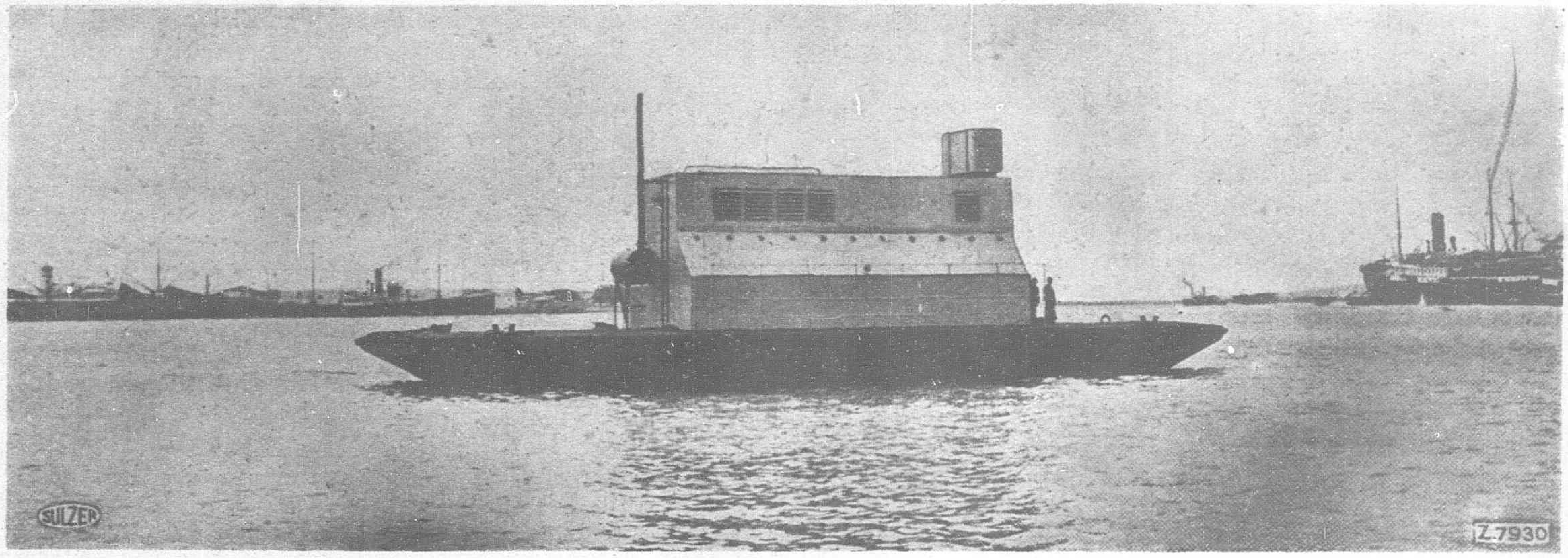


Figure 4.—The Special Earthing Wall-Plug designed by Mr. Williams

Flood Damage

It is estimated that the damage caused by floods to the various districts along the Peiping-Hankow Railway is at least $10,000,000. The losses sustained by salt merchants are especially heavy. Direct railway traffic is still suspended as the Suiping station is under water. The bridge near Chumatien has been repaired.—*Kuo Min.*



Electric power station, Banjermasin, Dutch East Indies, installed on boat and equipped with a Sulzer airless injection four-cycle engine, developing 600 b.h.p. at 250 revs. per min.

A Power Station Afloat

Unusual Problem Solved at Banjermasin, Dutch East Indies, when Sulzer Engine is Installed on Pontoon

A rather unusual method of extending an existing electric power station is represented by that adopted for the power station of an electric supply company in Banjermasin. Instead of installing a further set in the central station itself, the company has placed the new set on a pontoon specially built for the purpose. Local circumstances necessitated this unusual solution, because, when the company took over the existing power station in Banjermasin, it could not obtain permission from the authorities to build an extension to the station, although it was absolutely required. The authorities withheld permission because of the bad marshy ground on which the station is built. They were afraid of dangerous vibrations being set up, since trouble had already been experienced in Banjermasin from the engines working in the station taken over by the company.

Under these circumstances there were only two possibilities remaining to the electricity company:—they had either to erect the additional plant at a considerable distance from the existing power station, or to install it on board a pontoon. The directors rejected the first alternative because of the great difficulties and the high costs which would be incurred by the great distance from the principal consumers and the existing plant, and decided after thorough investigation to build a floating power station.

The company ordered the machinery for the novel type of power station from Sulzer Brothers, Winterthur. Such a power station requires that the set shall run absolutely free from vibration, a condition at once fulfilled by the choice of a Sulzer six-cylinder four-cycle Diesel engine, which has no free outer forces or moments. The engine works with direct injection of fuel and develops 600 b.h.p. at 250 rvs. per min. This new light type of engine is often adopted for stationary purposes, since it is very economical in fuel and lubricating oil consumption and has proved to be very reliable in service even when running continuously under severe conditions; it is also very simple to attend and maintain. For erection on the pontoon, the bedplate had to be somewhat modified. It is connected by strong tie rods to the box frame, which is totally enclosed and fitted with oil-tight doors, to all forced lubrication to be adopted. The cylinders are erected separately on the frame and have special cast-iron liners which are free to expand downwards. The cylinders are provided with water cooling, but the working pistons, which are of the trunk design, are uncooled. The camshaft, which is driven from the crankshaft through spur gearing, is located in a trough cast on the frame. The cams are keyed to the shaft and operate the valves in the usual method by means of links and push rods. Further the fuel pumps are fitted on the camshaft trough, so that they can be driven direct from the camshaft. The plungers are ground into their cylinders, and fuel delivery is regulated from a ball governor by means of the pump valves. The speed of the engine can be varied by 5% by adjusting the length of one of the governor rods. The pump pressure lifts the spring-loaded fuel valves, and fuel is injected into the combustion chamber through holes in the nozzle plate, which are arranged in such a way that the fuel is finely pulverized and well distributed throughout the combustion air.

A gearwheel pump driven from the main shaft draws the lubricating oil through a filter from the sump in the bed-plate and forces it, at a pressure of seven to 14 lb. per sq. in., through an oil cooler into the oil piping leading to the crankshaft, gudgeon pins and governor shaft. A lubricating apparatus driven from the governor shaft is provided for lubricating the cylinders. For cooling the cylinders under atmospheric pressure, a cooling water tank has been erected on the roof of the engine house; it is filled by a Sulzer centrifugal pump driven from the shaft of the engine; the pump runs at 2,050 revs. per min. and delivers 60 gals. per min. An electrically driven pump of the same size is provided as standby. The exhaust pipe of the engine is led to a silencer outside the engine room, from where the exhaust gases pass to the atmosphere through a pipe extending above the roof. Fuel is stored in two bunkers under deck and is raised from there into the daily service tank in the engine house by means of a handpump. From the daily service tank, the fuel flows under gravity into the tanks, which are fitted with float valves, and from them to the fuel pumps. Fig. 19 shows the set erected on board the pontoon.

The pontoon was built by the "Droogdok Maatschappij," Soerabaja, and is 82 ft. long and 26 ft. broad, with sides five ft. high and a draught of five ft. The deck is rectangular; the bottom of the vessel is raised at the bow and stern in order to facilitate towing, and the side walls have a slight slope. The pontoon is of the usual frame construction with two continuous side keels. Inside the engine room, in the direction of the axis of the Diesel set, the side keels are constructed as longitudinal bulkheads reaching up to the level of the engine house floor. In addition to that, between these longitudinal bulkheads, there are another two constructed as foundation for the Diesel engine; they extend over the whole length of the engine house and are only suppressed in way of the pit for the generator. The floor in the engine house, which lies deeper than the deck of the pontoon, is laid with removable chequer plates, whilst the pontoon otherwise has an ordinary steel deck. On the deck of the pontoon, double bollards are fitted at the bow and stern, two at each end, for mooring the ship to land and for fixing the

(Continued on page 429).

George Street Named Advisor

Mr. George Street, Commercial Representative of the Radio Corporation of America and of the Radio Corporation of the Philippines, has been appointed honorary Advisor of the Ministry of Communications at Nanking on radio telegraphy. The announcement of the appointment was made this month by the Minister of Communications, Mr. Wang Peh-chun.

Mr. Street is a newcomer to Shanghai, but he is a prominent and widely known figure in the radio-telegraph fraternity of the Pacific area. He was born in 1897, a native son of Oakland, California. His radio career was started as an amateur before he had his first long trousers. After attending Technical High School and receiving special tutelage in radio communications, Mr. Street set out at an early age to see the world aboard ship in the employ of the Marconi Wireless Telegraph Company of America.

During the World War he was a member of the faculty of the University of California as an instructor in radio-telegraphy in the School of Military Aeronautics. After a year of business experience, Mr. Street again associated himself with radio activities with the newly formed Radio Corporation early in 1920. He has been with this organization since that time.

George Street

He spent four years in Honolulu and another year in San Francisco in the trans-Pacific communication service and in 1925 was transferred to take charge of the corporation's activities in the Pacific Northwest. As the Manager of the Seattle office he gained a wider experience in the communication field, particularly in connection with communications to and from ships and remote points in Alaska.

Prior to coming to Shanghai, Mr. Street was also the Commanding Officer of Naval Reserve Communications of the 13th Naval District and took an active part in organizing the nation-wide Naval Reserve net-work in United States. His duty in China is looking after the communication interests of the companies he represents. China is the latest link to be connected to the vast RCA world-wide communication system and his work in this country is closely connected with the Chinese Government Radio Administration.

A Power Station Afloat

(Continued from page 428).

tow ropes. The engine house is also built of steel. In the lower part it is 18½ ft. broad, so that there is a free passage on both sides on deck. The upper part of the engine room is narrower and has four openings on each side and one opening at the end to admit air for the Diesel engine. A skylight is fitted above the engine.

For transmitting the electric energy generated, cables supported by floats lead from the pontoon to the switch gear in the power house on land, so that one mechanic is sufficient for attendance on board.

The plant has proved very satisfactory and works absolutely free from vibration under all conditions of service. A special advantage of such a floating power station is the possibility of using it for assisting power stations on land not far from the water at many different places. A floating power station can also be used with advantage in places where the future development of power requirements is uncertain and would therefore make the construction of a permanent power station on land rather a speculation. In the latter case it would, of course, be necessary to equip the floating power station with complete switch gear, so that the distribution of energy can be controlled from the pontoon. If, in the course of time, the necessity for a permanent power station arises, an ordinary plant can be built on land and the floating power station removed for use elsewhere. Such a plant is particularly suitable for supplying energy for work in connection with the regulation of rivers in thinly populated districts, since the work can then be carried out at once without transmission lines having to be erected over long distances.

When opening up fresh districts to cultivation,—work which in most cases is started from the rivers—such a movable source of power makes it possible to introduce machinery immediately and thus speed up the work of opening up the territory.

Already the possibility of moving the power station to another place to give temporary assistance has been made use of, since, just as it was ready for service and before being used in Banjermasin, it was put to work in Semarang in order to supply electricity to that district.

The Vickers Showroom

Messrs. Vickers and allied companies have opened a showroom at Vickers House, Broadway, Westminster, in order that customers, and especially those from abroad, may inspect the firm's manufactures without having to leave London. The extent of the Vickers organization can be gauged by the fact that it comprises more than twenty companies, some dating from before the war. Others were acquired during the war, or are the result of amalgamations or absorptions during the last few years of reconstruction. Obviously, no showroom could hold specimens of all the products of the Vickers organization, even in the form of models, and all the establishment at Westminster is intended to do is to present those products which, from time to time, appear to be of outstanding interest.

Naturally, a good portion of the space is devoted to the productions of Vickers-Armstrongs, Ltd. Among the exhibits of this group is the Vickers-Armstrongs 75 mm. mobile anti-aircraft equipment, which is the most modern development of an anti-aircraft weapon, and for its weight and power is claimed to be the most accurate gun in the world. It has a maximum horizontal range of 15,200 yards, and a maximum vertical range of 30,300 feet.

Water-Tube Boilers in some Recent Merchant Ships with Service Results

BY HAROLD E. YARROW, Esq., C.B.E., Member of Council

(Read at the Spring Meetings of the Seventy-second Session of the Institution of Naval Architects, March 27, 1931)

The adoption of water-tube boilers in the Merchant Service has been so rapid during the last few years that particulars of some of the recent installations, together with performances and costs of maintenance in service, may be of interest at the present time.

The installations forming the basis of this paper are listed in Table I., the majority of vessels shown being already in service. Oil firing is adopted on all these ships except the *Beaver* class cargo boats, which are coal fired mechanically. The table shows the generating heating surface of the boilers, the total evaporation at normal load, the weight of the whole installation, and the floor-space occupied. Attention is directed to the notes accompanying the table at the foot. Only the main boilers which supply steam for the propelling machinery are included, auxiliary boilers, whether Scotch or water-tube, being omitted, although in some cases the auxiliary boilers supply a small proportion of steam to the main engines apart from their use for auxiliary services and port duties.

In any analysis of Table I. it is to be remembered that many factors influence the design of a boiler installation, and these all have a bearing on evaporation per ton weight and per square foot of total boiler-room area. For instance, a vessel may have a boiler-room of small height relative to area, which necessitates the boilers being low and wide and, for a given rating, tending to reduce the evaporation per square foot of floor-space. In all instances adequate access is provided round the boilers.

As regards evaporation per ton weight, working pressures govern the thickness of pressure parts and therefore weight, also the method of construction interacts on this aspect. Boilers that must occupy a small floor area are made of greater height and require heavier supporting structure, as on the P. & O. liners *Strathnaver* and *Strathaird*. Space and weight are also largely affected by rating and overall efficiency, and figures are added for a modern cruiser and a modern destroyer of similar boiler design by Yarrow & Co. to show the extent that a water-tube boiler can be forced without risk (continuously at normal load) when output is the first consideration. Between the limits of highly efficient liner ratings and naval requirements come many intermediate classes of vessel such as cross-Channel steamers, yachts, ferries, etc.

Allowing for all qualifying factors, Table I. clearly indicates the advantage, from the point of view of floor area, of adopting large units. For the *Strathnaver* and *Strathaird* the evaporation per square foot of floor area is over 60 per cent greater than for the *Viceroy of India*, and large units have, in addition, the further advantage of fewer fittings, simpler pipe arrangements, and less stokehold staff being required.

TABLE I.

Vessel.	*Number of Yarrow Boilers each*	*Total Generating Heating Surface. Square Feet.*	*Total Evaporation, Normal Load. Lb./hour.*	*Evaporation per Square Foot of Generating Surface. Lb./hour.*	*Total Weight with Water. Tons.*	*Total Area of Boiler-room. Square Feet.*	*Evaporation per Ton Weight. Lb./hour.*	*Evaporation per Square Foot of Area. Lb./hour.*	*Remarks.*
Duchess of Atholl *Duchess of Bedford* } (C.P.S.) ..	6	30,700	153,500	5	500	4,188	307	36.7	In service
Beaverford *Beaverdale* *Beaverburn* } (C.P.S.)	4	12,620	64,000	5.06	292	2,350	219	27.2	In service
Viceroy of India (P. & O.) ..	6	32,500	180,000	5.54	500	3,750	360	48	In service
Duchess of Richmond *Duchess of York* } (C.P.S.) ..	6	32,270	161,350	5	522	4,188	310	38.6	In service
Empress of Japan (C.P.S.) ..	6	52,950	264,750	5	1,026	4,275	258	62	In service
Empress of Britain (C.P.S.) ..	8	99,550	497,750	5	1,872	7,722	266	64.5	Under construction
Prince Henry *Prince David* *Prince Robert* } (Canadian Nat. Railways, Ltd.).	6	27,300	142,000	5.2	457	3,330	311	42.7	In service
Strathnaver *Strathaird* } (P. & O.).. ..	4	50,000	275,000	5.5	900	3,520	306	78.2	Under construction
Carthage *Corfu* } (P. & O.)	4	25,200	138,800	5.51	392	2,780	354	50	Under construction
Rangatira (U.S.S. Co. of N. Z. ..	6	27,600	151,800	5.5	480	2,800	316	54.2	Under construction
Conte di Savoia (Lloyd Sabaudo).	Particulars not yet available for publication								
New Cunarder	Particulars not yet available for publication								
Cruiser (Foreign)	6	73,910	1,236,000	16.75	390	3,500	3,170	353	In service
Destroyer (Foreign)	3	22,090	387,000	17.5	165	1,600	2,345	242	In service
Vessels with other water-tube boilers :—									
Bremen (three drum water-tube boilers with bent tubes) ..	20	183,000	900,000	4.9	—	16,600	—	54.2	In service
Europa (three drum water-tube boilers with bent tubes) ..	24	—	—	—	—	—	—	—	In service
Statendam (Babcock & Wilcox boilers)	6	42,960	210,000	4.9	744	4,278	282	49	In service
Rajputana (with D.E. Scotch boilers)	6	38,340	230,000	6	900	4,867	255	47	In service

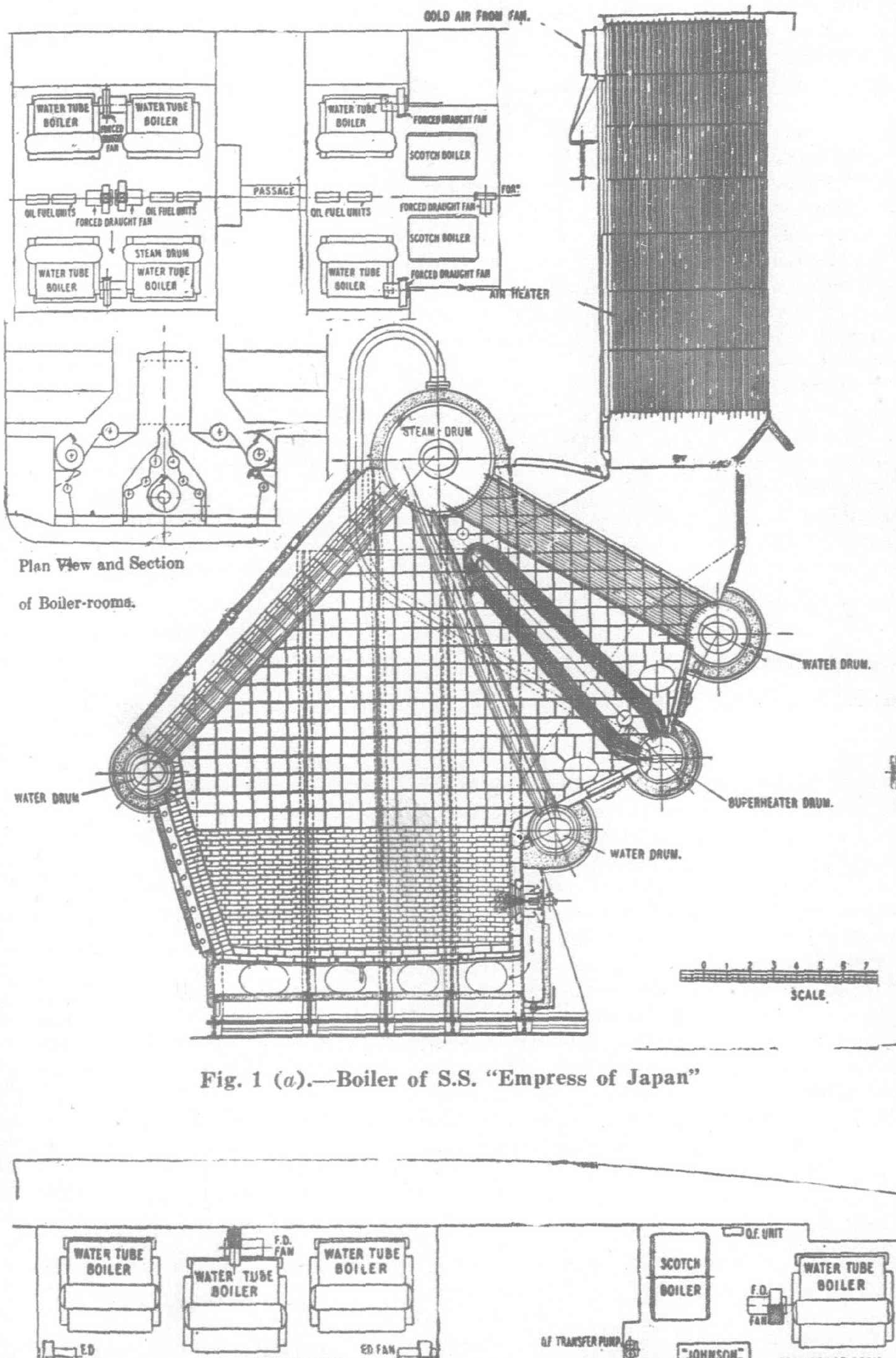
NOTES.—Total weights include boilers, superheaters, and air heaters up to top of air heaters, the boilers being complete in all respects with water to working level.

All installations are oil fired except the *Beaver* vessels, which have mechanical stokers burning coal.

In considering the above table, it is to be remembered that every installation has been designed to suit the particular circumstances of the vessel. Space available, rating, overall efficiency, pressure, etc., all influence "Evaporation per ton weight" and "Evaporation per square foot of area," so that comparisons can only be general.

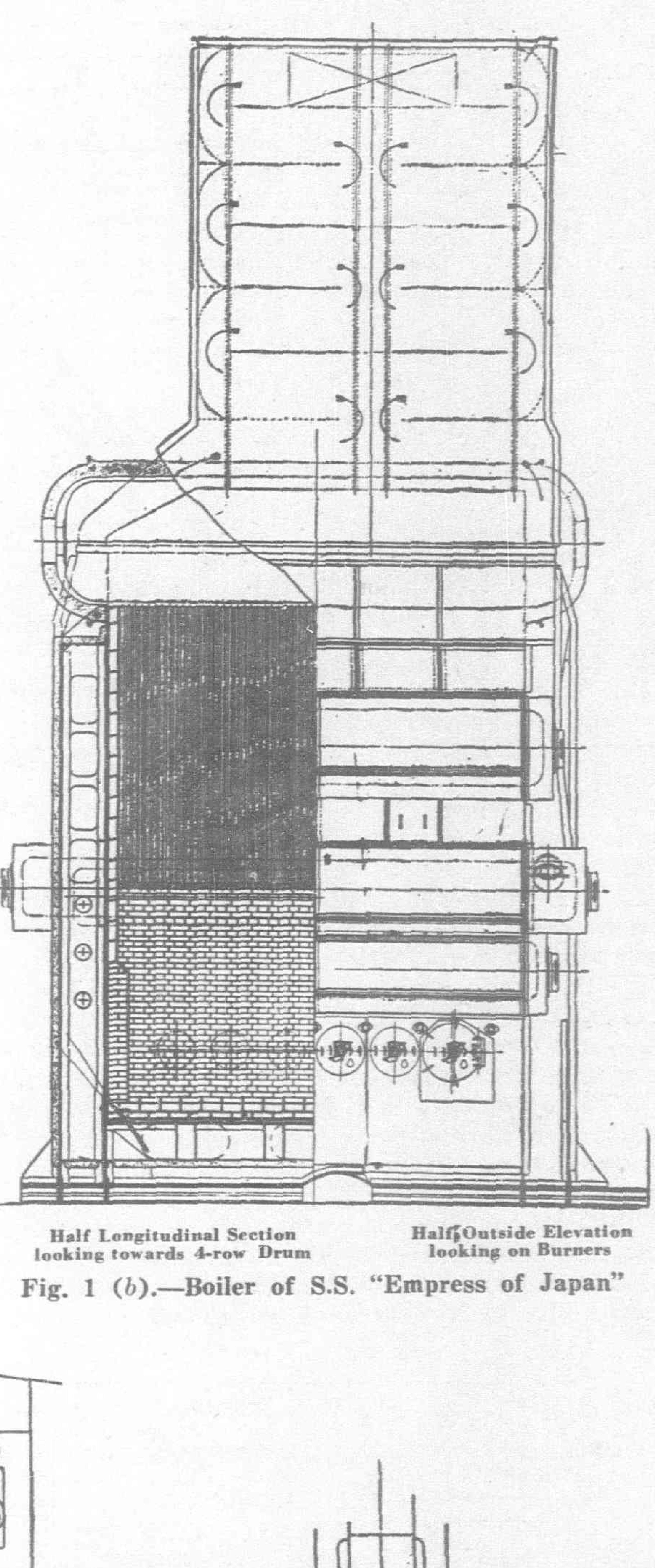
Endeavor has been made to collect some corresponding information for the *Bremen* and *Europa*, the boilers of which are also of the three-drum type, but with bent tubes and horizontal superheaters, and approximate figures are given in Table I. Particulars of the *Statendam*, which has Babcock and Wilcox boilers, are included from Admiral Whayman's paper already referred to, and also, at the bottom of Table I., details are added for the P. & O. liner *Rajputana*, which is fitted with Scotch boilers.

The installation on the *Rajputana* is representative of modern Scotch boiler practice, the boilers being oil-fired and of the double-ended type conducive to minimum space and weight for output. The *Viceroy of India* and *Rajputana* form an interesting comparison from the boiler point of view, and although the *Viceroy* is of about 1,000 h.p. greater power, the *Rajputana* requires 50,000 lb. per hour more steam. (The boiler efficiency, steam pressure, and temperature are lower on the *Rajputana*, and the engine efficiency



Plan View and Section of Boiler-rooms.

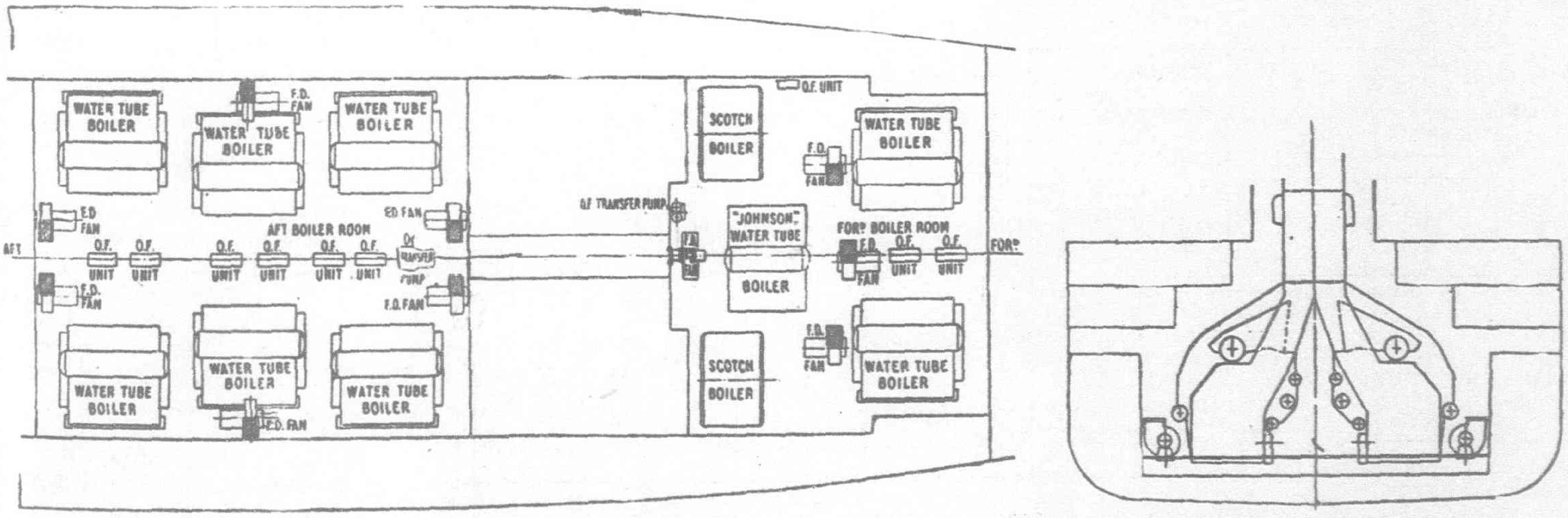
Fig. 1 (*a*).—Boiler of S.S. "Empress of Japan"



Half Longitudinal Section looking towards 4-row Drum

Half Outside Elevation looking on Burners

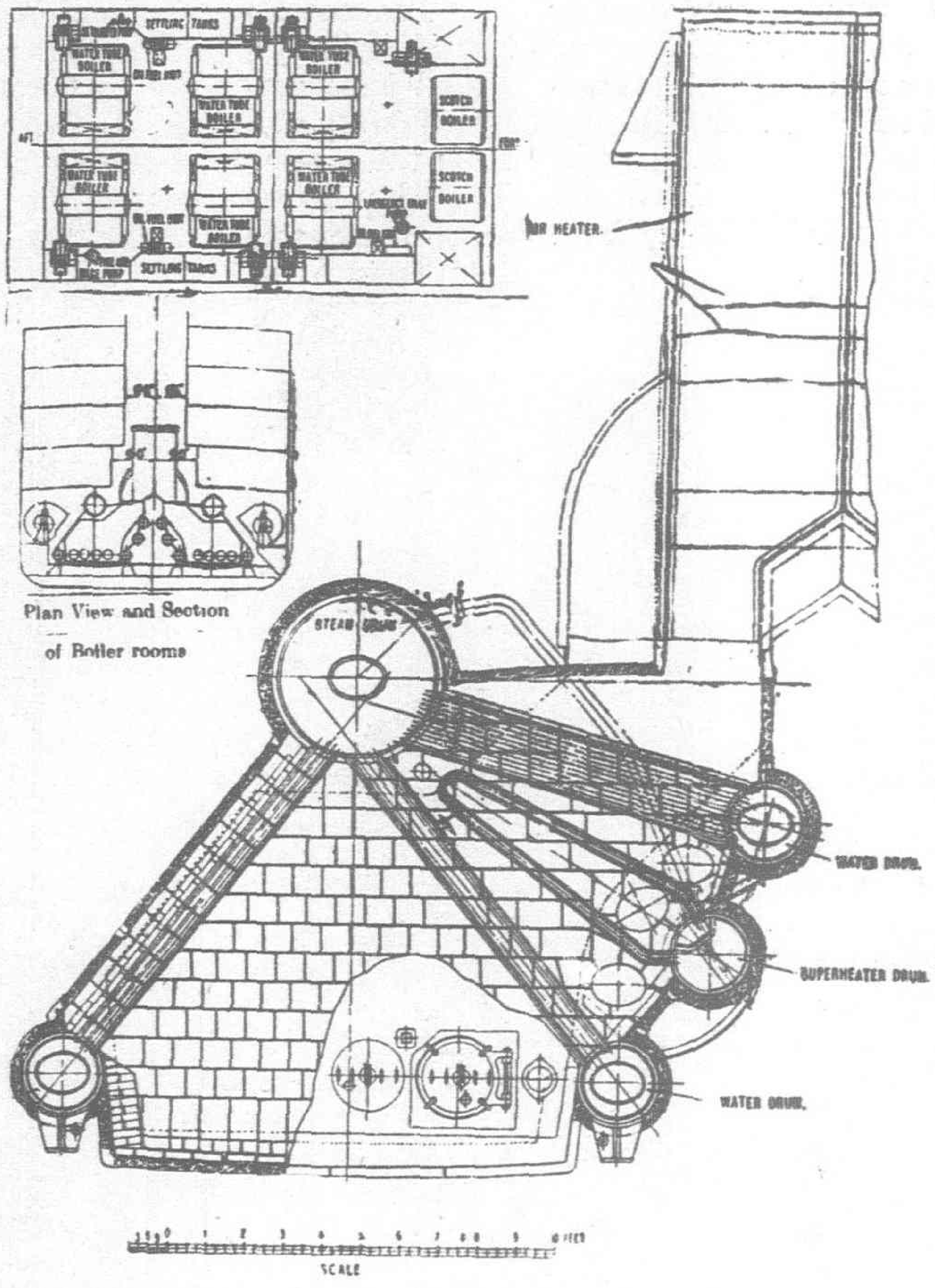
Fig. 1 (*b*).—Boiler of S.S. "Empress of Japan"



Plan View and Section of Boiler-rooms

Section through Aft Boiler-room at Centre Boilers

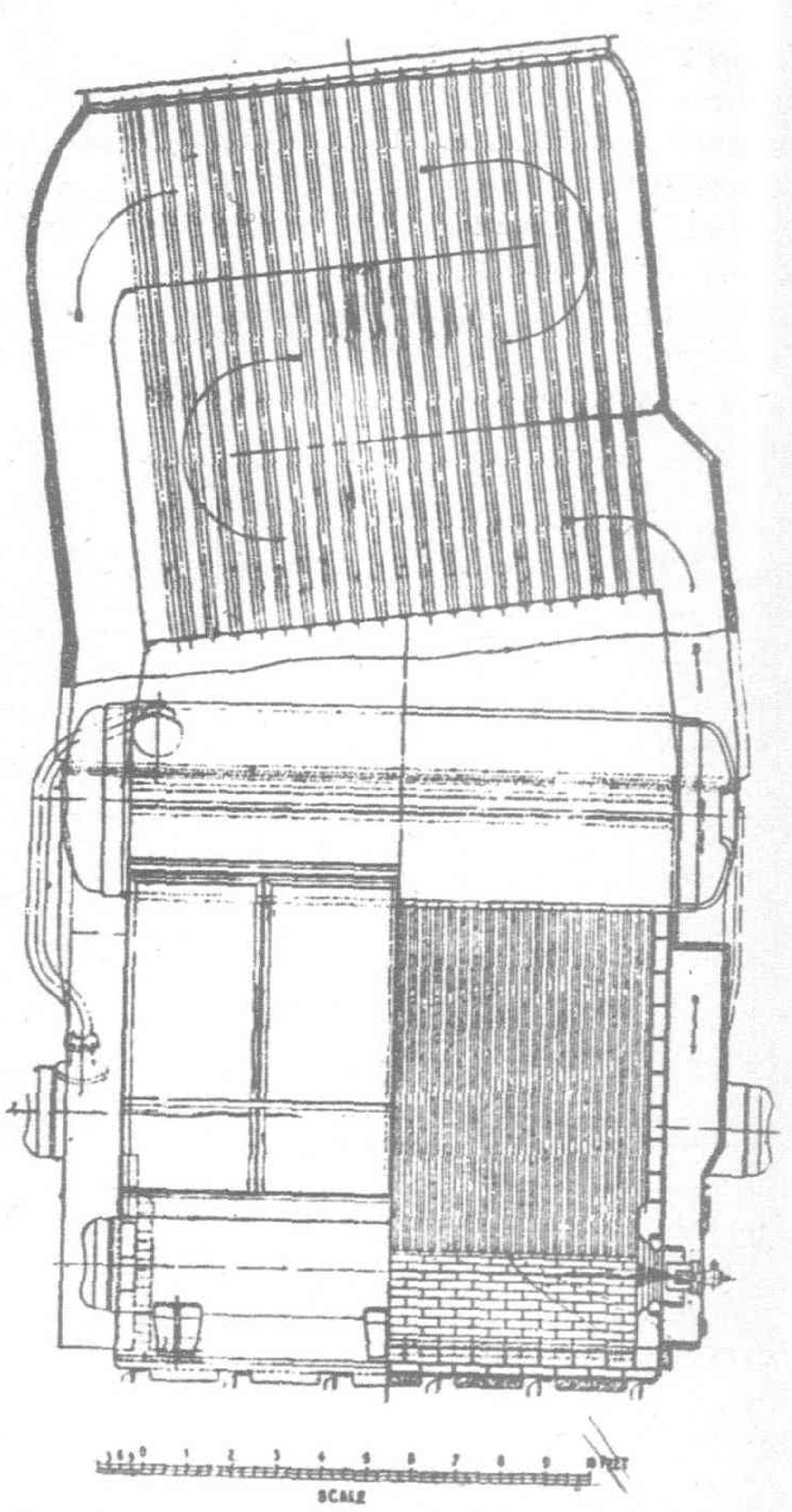
Fig. 4.—S.S. "Empress of Britain"



Plan View and Section of Boiler rooms

Sectional Elevation looking towards Back of Boiler

Fig. 3 (*a*).—Boiler of "Prince" Class Vessels



Half Longitudinal Elevation, Outside of Boiler

Half Longitudinal Elevation, Sectional

Fig. 3 (*b*).—Boiler of "Prince" Class Vessels

is less.) Both vessels have native stokehold complements, six men per watch being required to look after the *Rajputana* Scotch boilers, against four per watch for the boilers on the *Viceroy of India*, which alone represents an appreciable saving in cost of running. Owing to the better layout given by the larger sizes, it is anticipated that only three natives per watch will be required for the water-tube boilers on the *Strathnaver*, although the power is 60 per cent greater than the *Viceroy of India*.

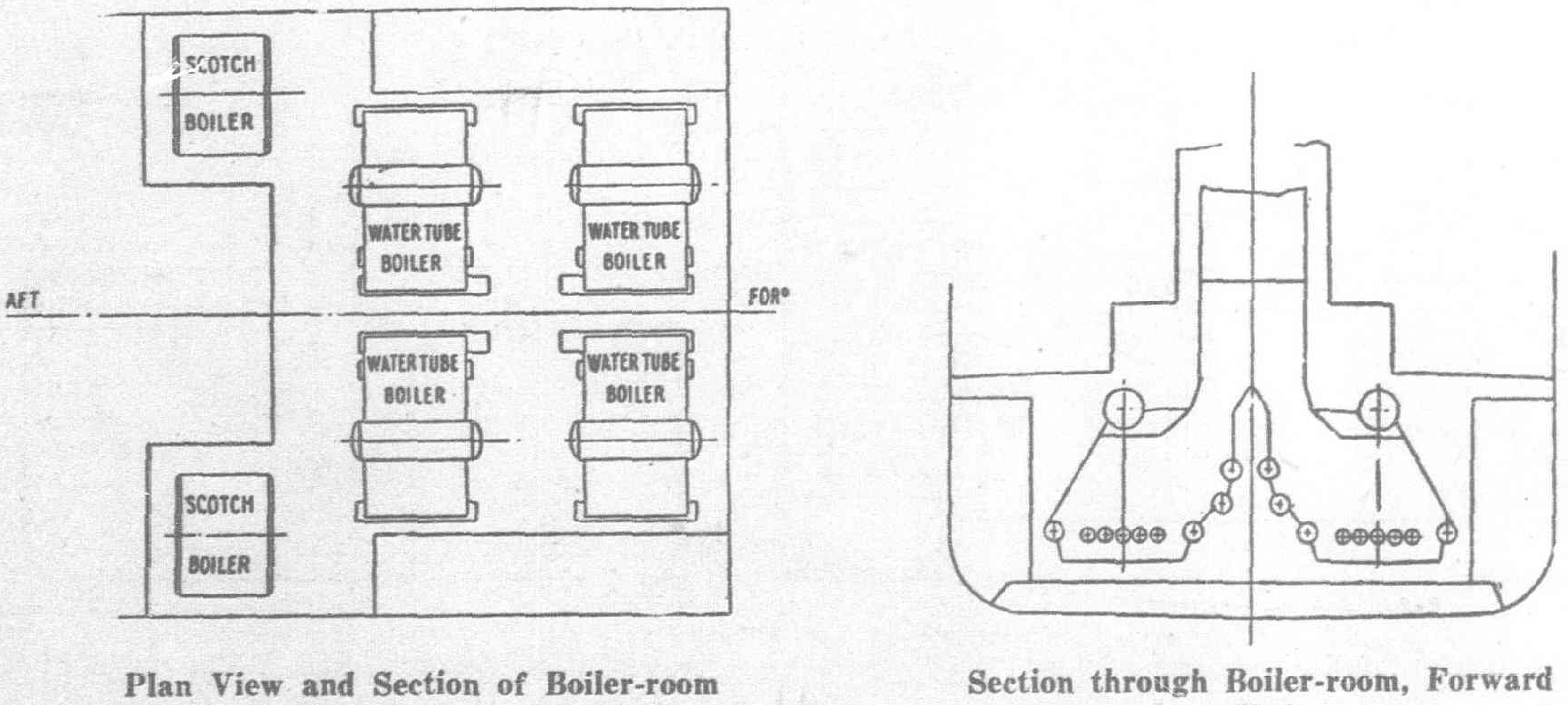
On the *Empress of Britain* a boiler of the Johnson type is installed, making a total of nine main water-tube boilers for this vessel, but only the eight Yarrow boilers are included in the table, so that a direct comparison can be made with other vessels. The *Princess Helene*, another recent steamship owned by the C. P. S. Co., and which is in service, also has one Johnson boiler forming part of the stokehold installation.

To illustrate the paper a selection of designs is shown, comprising (*a*) section, (*b*) elevation, and (*c*) layout, for the boilers of the *Empress of Japan* (Plate I.), *Strathnaver* and *Strathaird* (Plate II.), and *Prince* vessels (Plate III.), while Figs. 4 and 5 (Plates II. and III.) show the layout of the boilers of the *Empress of Britain* and *Carthage* and *Corfu*. The *Viceroy of India* and *Beaver* class have already been described in the technical Press, and are of the single-flow type similar to those of the *Duchess* vessels, *Prince* vessels, and *Carthage* and *Corfu*. On the *Prince* class vessels, to suit other considerations, the stokehold was of low height, and the drawing shows the layout evolved to meet this requirement.

The *Strathnaver* and *Strathaird* and *Empress of Britain* have double-flow Yarrow boilers, *i.e.* the gases pass both sides of the saturated steam drum and the superheater is at one side only. Dampers are provided, as shown on the drawing, at the junction of the uptakes above the saturated steam drum of each double-flow boiler; operation of these dampers regulates the amount of gases passing the superheater, and thus enables the final steam temperature to be controlled within certain limits.

In all cases the general design is the same, but in the larger sizes the boilers are fired from the side instead of the end. Side firing is advisable for a large boiler to ensure that the heat is evenly distributed throughout the whole width, and also facilitates the general arrangement in a large stokehold by enabling the boilers to be fired on either side of a central aisle as in a land power station. All the boiler drums, whether with side firing or end firing, are arranged in a fore and aft direction; this is important to maintain steady running and efficiency during bad weather.

To allow for greater expansion, large size boilers are supported from the saturated steam drum in such a way that the nests of tubes are quite free to expand longitudinally. The boiler casings are arranged as air ducts for the air on its way to the burners, and at the sides are stiffened and braced to form box girders, which carry the saturated steam drum at each end. Smaller boilers are supported on feet riveted to the lower water drums, these feet resting on stools forming part of the ship's structure. Superheaters consist of U tubes expanded into a drum of forged construction, this drum having internal divisions to provide the required number of passes for the steam through the superheater. The superheater tubes are steeply inclined and self-draining and the large integral drum acts as a steam receiver. The air heaters are of the tubular type, and are adapted to the layout of uptakes best suited for each particular vessel. In addition to the usual mountings, important accessories are feed-water regulators, soot blowers, and low water alarms.



Plan View and Section of Boiler-room

Section through Boiler-room, Forward End

Fig. 5.—S.S. "Carthage" and "Corfu"

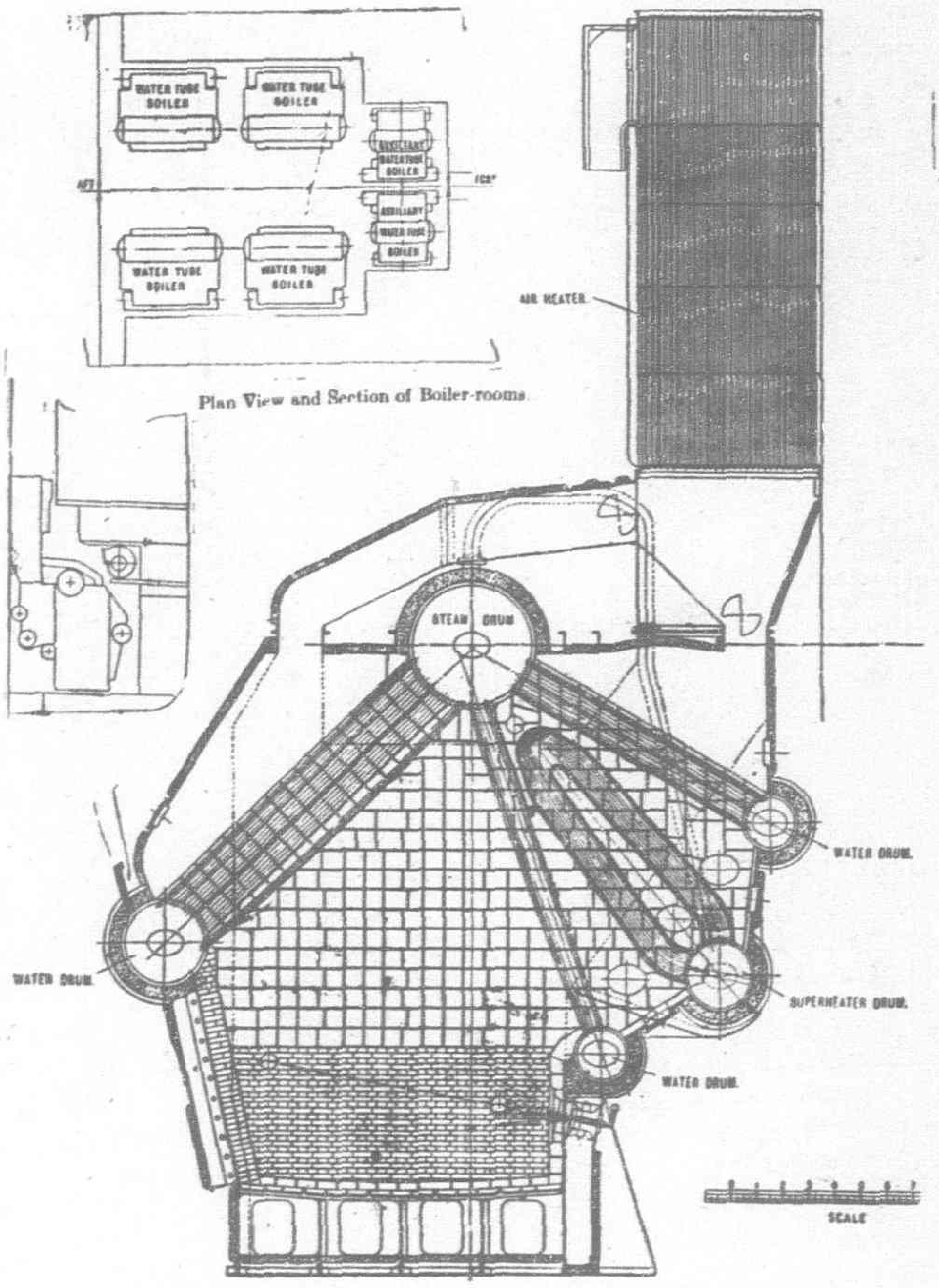
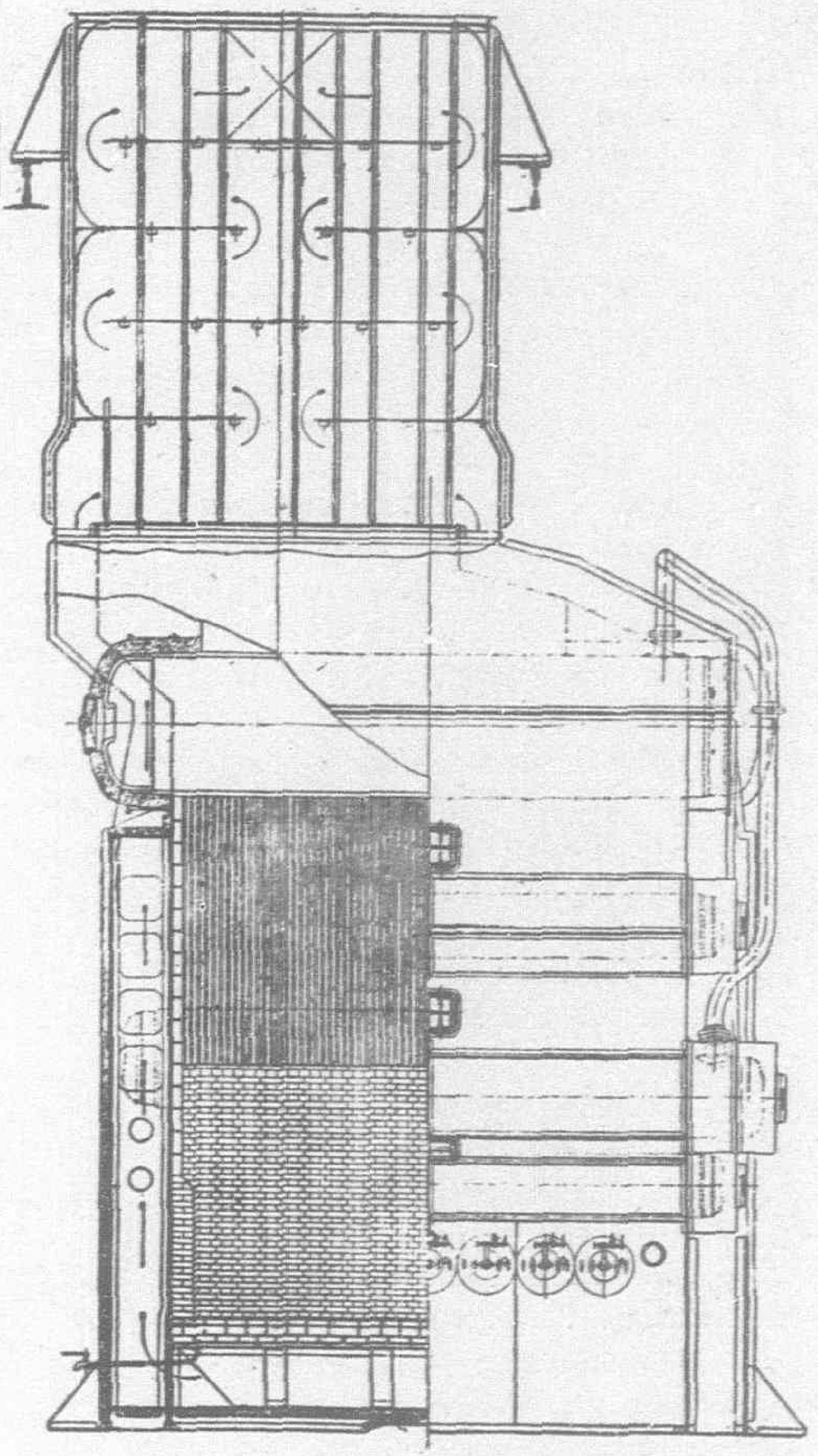


Fig. 2 (*a*).—Boiler of S.S. "Strathnaver" and "Strathaird"



Half Longitudinal Section, looking towards 17-Row Water Drum **Half Elevation, looking on Burners**

Fig. 2 (*b*).—Boiler of S.S. "Strathnaver" and "Strathaird"

The plan layout of each installation shows the auxiliary boilers in position. Scotch boilers are adopted in all the merchant vessels for auxiliary purposes, except the *Strathnaver* and *Strathaird*, for each of which the P. & O. Company have decided to have two small auxiliary Yarrow boilers in addition to the four main units.

Table II. is of performances at approximately normal output. The proportions of air-heating surface vary somewhat throughout, and the steaming conditions differ in the various installations. Boiler rating is also expressed in the form of B.Th. U.s per square foot of generating surface per hour to indicate a true comparison of boiler performance, and the figures for rating take no account of heat imparted to the] superheaters. Trial efficiencies have usually been improved upon in service as the operating staffs became familiarized with the best running conditions. A large margin of overload capacity is provided on all installations, and this aspect is purely a matter for consideration in fixing the sizes of fans, fuel plant, etc., as will be apparent from a glance at the ratings attained in cruisers and destroyers (Table I.). As an indication of funnel temperature, the temperature of gases leaving the air heaters is about 290°F. on the *Viceroy of India* and about 275°F. on the *Empress of Japan*.

Table III. gives some particulars of actual costs of service maintenance and upkeep. Figures are given of the *Duchess of Richmond*, *Duchess of York*, *Beaverburn*, and the *Viceroy of India*, and in all cases the Board of Trade annual survey is included and the repairs that this survey required. The steamers of the *Duchess* class and the *Viceroy of India* have been in operation about two years, and the *Beaverburn* over three years. The *Beaverburn* is equipped with mechanical stokers, and although the cost of upkeep to these stokers is not included, it is understood that repairs have been few, and it is interesting to note that Mr. J. Johnson has equipped the two other *Beaver* class vessels with mechanical stokers, *viz.* the *Beaverhill* and *Beaverbrae*. These last two vessels have Babcock and Wilcox boilers, and were originally hand fired; one is now fitted with Taylor stokers and the other Erith-Roe stokers. The development of mechanical stokers on board ship is one that will be watched with considerable interest, as there are many advantages in this method of mechanical firing.

The maintenance costs are the average during the time the vessels have been in service. In the case of the *Viceroy of India*, the figures are given for the first year's running, and it is understood that for the second year they are less. It is interesting to record that the approximate steaming distance of the *Viceroy of India* during a period of two years is about 150,000 miles, and the total boiler maintenance during this period works out at about 1½d. per nautical mile.

Although details of the large installation of water-tube boilers for the new 1,000 ft. express liner which the Cunard Company are

(Continued on page 437)

TABLE II.

Vessel.	*Beaver Class.*	*Viceroy of India.*	*Duchess of Richmond.*	*Prince Henry.*	*Empress of Japan.*	*Strathnaver.*
Number of Yarrow boilers.	4	6	6	6	6	4
Generating surface, square feet	12,620	32,500	32,270	27,300	52,950	50,000
Evaporation per hour, total lb.	64,000	180,000	161,350	142,000	264,750	275,000
Water per square foot generating surface per hour, lb.	5.06	5.54	5	5.2	5	5.5
Evaporation per boiler per hour, lb.	16,000	—	26,890	23,670	44,125	68,750
Blow-off pressure, lb./sq. in.	265	400	370	370	425	425
Steam temperature, °F.	650	700	725	675	725	725
Feed temperature, °F.	200	300	300	300	300	350
B. Th. U. per square foot generating surface per hour	5,280	5,260	4,750	4,940	4,760	4,950
Type of fuel	Coal	Oil	Oil	Oil	Oil	Oil
Fuel per hour, lb. (Designed)	8,600	12,400	11,570	9,570	18,300	17,900
Gross calorific value of fuel, B. Th. U.	11,000	19,000	19,000	19,000	19,000	19,000
Overall efficiency on gross calorific value of fuel, per cent.	80 per cent. guarantee 83 per cent. on service	84 per cent. guarantee 87 per cent. on service	82 per cent. guarantee 85.5 per cent. on service	85 per cent. guarantee —	85 per cent. guarantee 88 per cent. on service	86 per cent. guarantee Not on service yet

NOTE.—Efficiencies based on the nett or lower calorific value of the fuel are 3 per cent to 4 per cent higher with coal and 4 per cent to 5 per cent higher with oil.

New T.K.K. Cargo Motor Ship "Soyo Maru"

Special Features Incorporated into New Vessel Built in Asano Dockyard at Yokohama

By Our Special Correspondent

The *Soyo Maru* was built in the Asano Dockyard, Ltd. of Yokohama for the order of the Toyo Kisen Kaisha, Ltd. and her machinery was supplied by the Kobe Steel Works, Ltd.

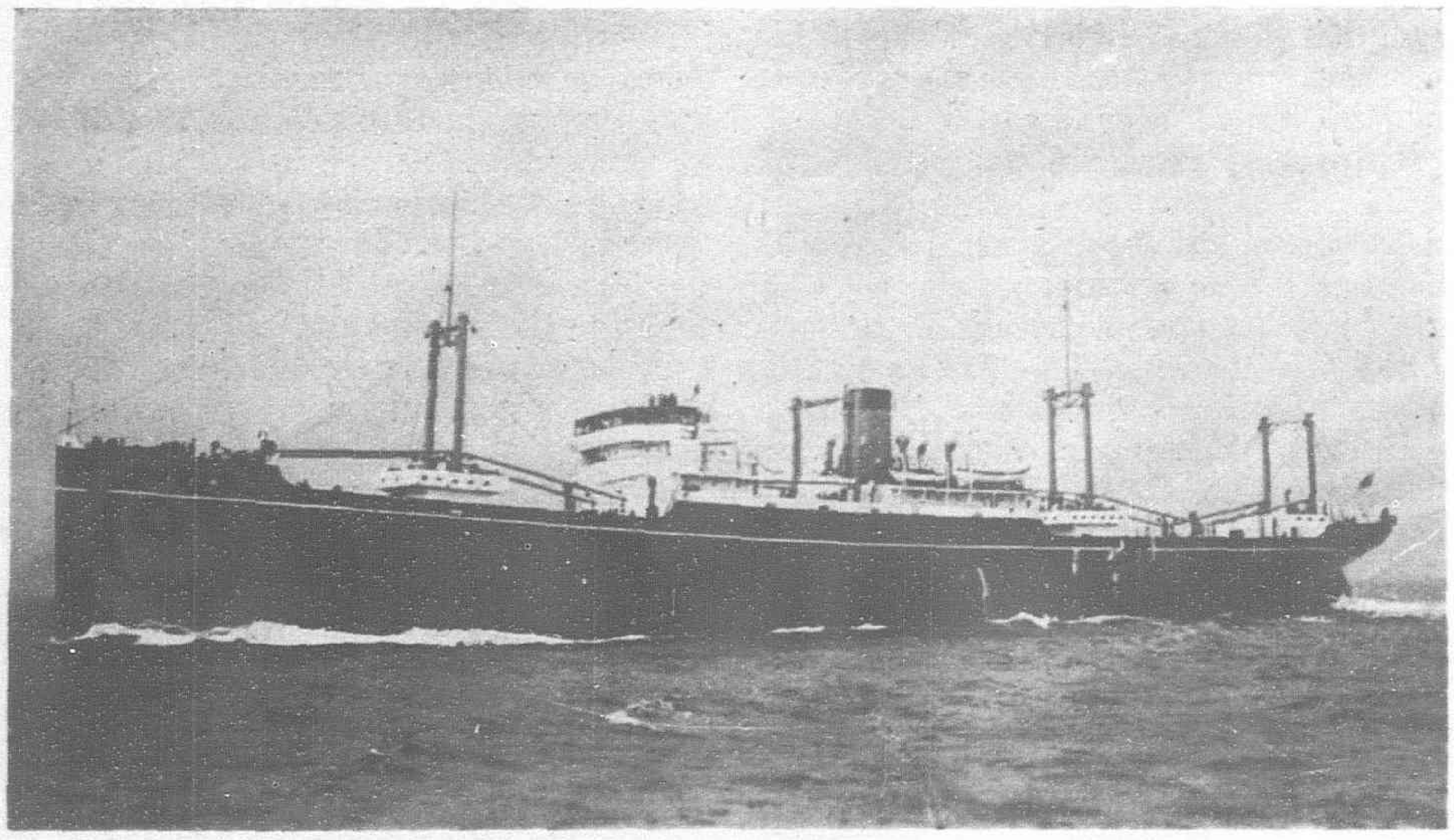
The vessel is a sister ship of the *Ryoyo Maru* built in the Kawasaki Dockyard of Kobe. The latter is installed with a M.A.N. double-acting air-injection two-stroke cycle Diesel engine supplied by the Machinenfabrik Augsburg-Nürnberg A.G. of Germany, whilst the main engine of the *Soyo Maru* is of the Shinko-Sulzer single-acting two cycle air-injection type built in the Kobe Steel Works.

The vessel was laid down in the Asano Dockyard on March 6, 1930, launched on October 4, 1930, and completed on January 17, 1931.

Principal Particulars.

Length over all	432′-0″
Length between perpendiculars	415′-0″
Breadth moulded	56′-0″
Depth moulded	31′-9.66″
'Tween deck heights	8′-0″
Gross tonnage	6,081.46 tons.
Maximum speed	15.412 knots.
Service speed	12.0 knots.
Main engine :—One set of Shinko-Sulzer single acting air-injection two cycle Diesel engine, 6ST68 type.	
Normal output	3,200 b.h.p.
Corresponding r.p.m.	110

The vessel is classified by the Imperial Japanese Ministry of communications as "The First Class Ocean-service Cargo Ship," and as + 100 A1. with L. M. C. by Lloyd's Registry, and also is furnished with the Panama Canal and Suez Canal tonnage certificates and the Australian Government's certificate for the cargo handling appliances.



The "Soyo Maru" as she appeared on her trial run.

General Arrangement and Hull Construction

The vessel has two complete steel decks extending over the whole length of the ship, a forecastle, a poop and a bridge deck. The hull is subdivided into six holds, one engine room, fore and aft peak tanks by eight water-tight bulkheads, extending to the upper deck, except those between Nos. 2 and 3 holds and between Nos. 5 and 6 holds which reach only to the second deck, so as the 'tween deck cargo spaces above these holds to be communicated for embarking lumber and lengthy materials. No. 4 hold is arranged alteratively to be used as deep tanks in case of necessity and is provided with an oil-tight middle line bulkhead. Two expansion trunks are provided to each cargo hold, fitted direct to the main transverse bulkheads.

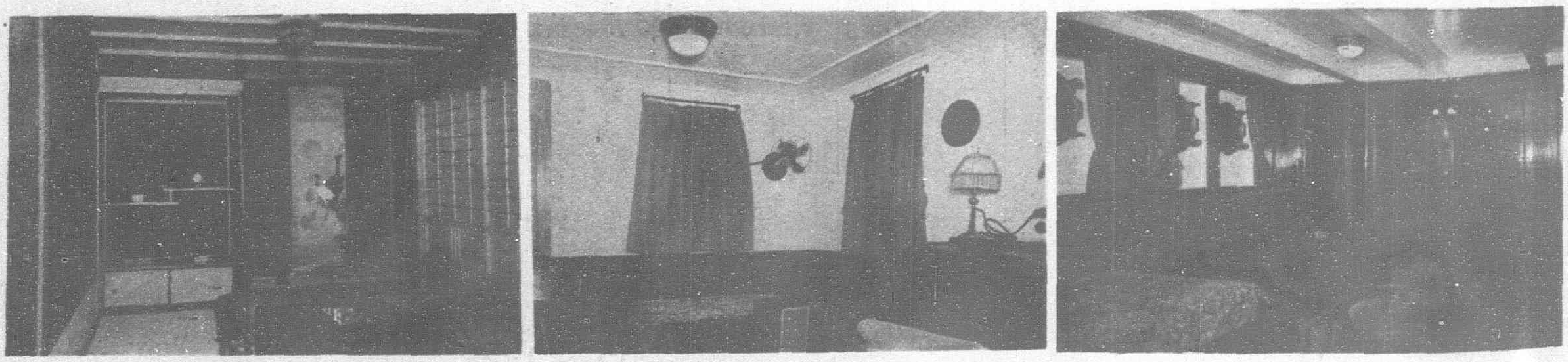
The double bottom extends from the collision bulkhead to the aft peak tank bulkhead, holding a height of 3 ft. 8 inches throughout and is mainly arranged for the carriage of fuel oil, except under the engine room where fresh water tanks being provided and kept clear from the adjacent oil tanks by cofferdams.

The vessel has an upright funnel utilized for the stowage of a silencer for the main engine, and four twin posts, two of which being connected by truss work at heads and fitted with small poles at middle in order to serve as the fore and main masts. The twin posts are also utilized as ventilators of the cargo holds.

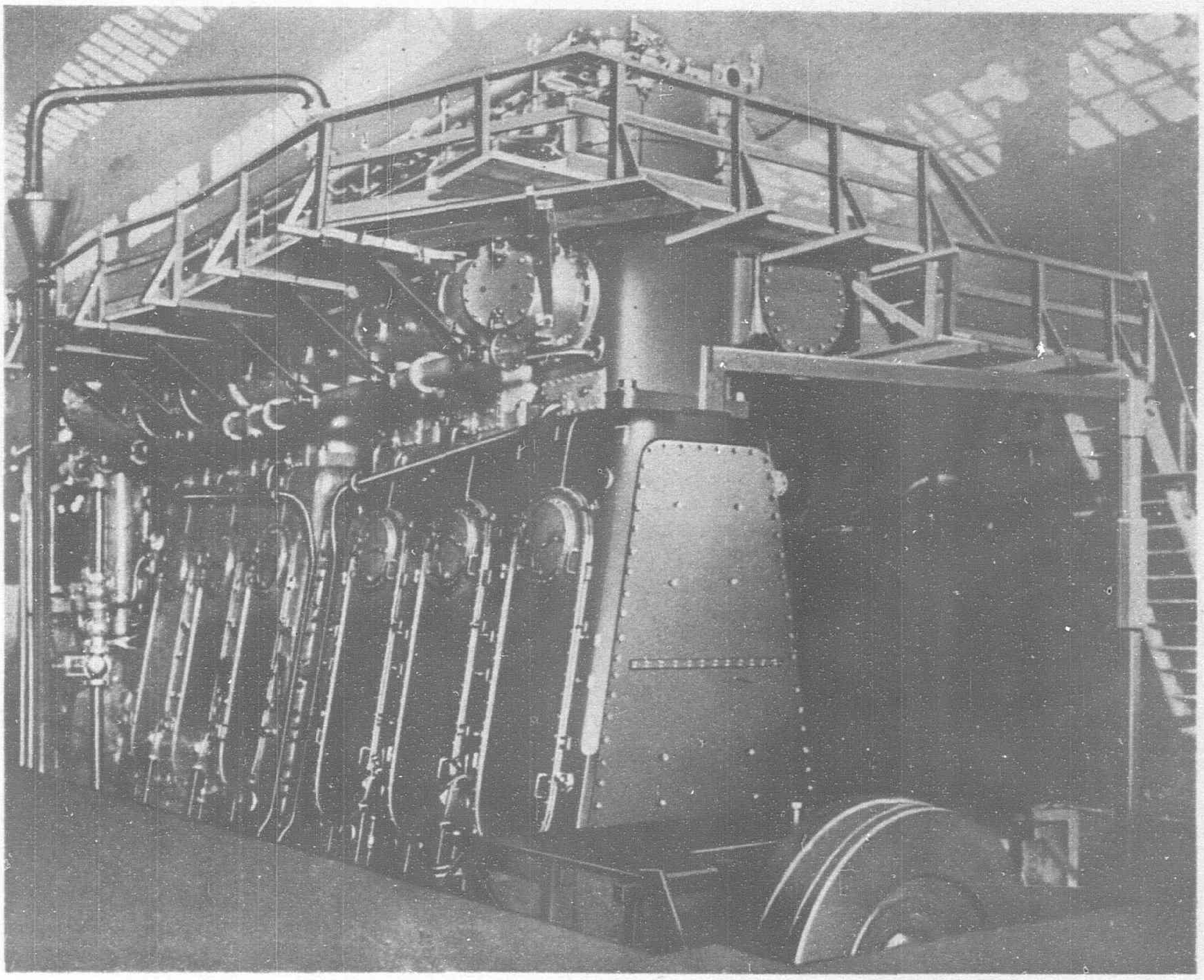
The stern post, rudder and propeller are of Ono's improved types, which are so designed as to reduce the loss of power due to water disturbance as well as to ensure easy and efficient handling of the ship. The model of the ship was towed in the Experimental Tank of the Imperial Ministry of Communications.

All living quarters being arranged under the deck erections amidships, ample daylight and fresh air are available. On the navigation bridge deck are the captain's room, owner's cosy Japanese room, a wireless telegraphy office and operator's room, bath and lavatory, etc.

On the forward part of the bridge deck are an airy dining saloon at middle, officers' cabins, a doctor's room, a spare room, a boys' room, a pantry, officers' bath and lavatory, etc. The aft part of the bridge deck



Interior views of the Vessel, left to right, the owner's room, Captain's day room and officers' dining room



Showing the Main Engine of the "Soyo Maru"

is for the engineers' accommodation, where the chief engineer's room, engineer officers' cabins, a spare room, a clerks' office, a mess room, the ship's galley, engineers' bath and lavatory, stores, etc. are arranged. Between these forward and aftward quarters, No. 3 cargo hatchway is situated.

On the upper deck amidships in clear off the engine casing, cabins for petty officers, seamen and oilers, mess rooms for sailors and oilers, cold chambers, sailors' and oilers' baths and lavatories, etc. are arranged.

Cargo Handling Appliances

The vessel carries 9,108.3 tons of cargo (458,582 cubic ft. of bale) including 17,414 cub. ft. of silk, 2,360 tons of fuel oil and 95 tons of fresh water, for which six cargo holds, five 'tween deck cargo spaces, a bridge cargo space etc. are arranged.

Nos. 2 and 3 cargo spaces being communicable and No. 6 cargo space covering over Nos. 5 and 6 cargo holds, lumber and other lengthy articles can be conveniently embarked; for this purpose numerous steel ring bolts are fitted in these spaces. On the upper deck, a large number of fittings to stand pillars and to secure deck cargoes being provided, it is possible to embark lumber up to a height of 18 feet upon the deck.

There are six hatchways, each being equipped with two five ton derrick booms, except Nos. 2 and 6 hatchways provided with eight ton derrick booms.

Sizes of the hatchways and lifting capacity of winches are as follows :—

Hatchways	*Size*	*Lifting Capacity and Number of derricks*	
No. 1 Hold	29′-3″ × 20′-0″	3 tons	2 in No.
No. 2 ,,	30′-3″ × ,,	5 ,,	2 ,,
No. 3 ,,	30′-3″ × ,,	3 ,,	2 ,,
No. 4 ,,	22′-0″ × ,,	3 ,,	2 ,,
No. 5 ,,	30′-3″ × ,,	3 ,,	2 ,,
No. 6 ,,	30′-3″ × ,,	5 ,,	2 ,,

All winches are of the latest Laurence, Scott's electric type, installed on winch platforms, so as to have a clear deck for the carriage of deck cargoes and the spaces under the platforms are utilized for boatswain's store and gear store.

Three ton winches are eight in number and are driven by a 35 h.p. electric motor with a lifting speed of 120 ft. per min., while five ton winches are four in number with a 44 h.p. motor at 100 ft. per minute.

Anchor and Steering Arrangement

A Clarke, Chapman's electric windlass is fitted on the short forecastle deck with an anchor telegraph at the end, and is capable to lift a load of 15 tons at 30 ft. per min. The driving motor being of 68 h.p. and is installed below the forecastle deck. Diameter of cables is 2-5/16 ins.

The steering gear is of the Hele-Shaw patent hydo-electric type, supplied by Messrs. John Hestie & Co., and is driven by two sets of 18 h.p. electric motors, all being installed in the steering engine room on the upper deck at stern, and is controlled by Mactaggart Scott's telemotor system.

Miscellaneous Appliances

All necessary navigation appliances such as standard and steering compasses, steering telemotor, electric helm indicator, mechanical engine telegraph, combined docking and steering telegraph, electric ship log, anchor telegraph, etc. are provided on the flying bridge.

The wireless telegraphy and telephony apparatus is of the Nippon Wireless Company's valve type of 1 kw. capacity, whilst a ¼ kw. apparatus is fitted as spare. A group of accumulators of 220 volts-50 ampere hour is provided for the wireless installation as well as for the independent lighting at night. A wireless direction finder supplied by Telefunken A.G. of Germany is fitted on the standard compass platform.

As to the inter-communication system, navyphones are fitted for the communication between the navigation bridge and the engine room, apart from usual telephones, voice pipes, etc. for general uses. Automatic electric alarms are fitted to every important machine on board.

The life-saving appliances comprise two lifeboats of 28 ft. by 8 ft. by 3 ft. 3 ins. and one "Temma" of 18 ft. by 5 ft. by 2 ft. together with life buoys and jackets.

The cold chamber has a capacity of 618 cub. ft., for which a Sabro's 5½ h.p. Co^2 refrigerating machine is installed.

All living quarters are well ventilated and lighted, and have steam and electric heaters, fans, electric and oil lamps, and all other necessary equipments.

As forementioned, a special Japanese room designed to suit the owner's taste is arranged on the navigation bridge deck.

Main and Auxiliary Machinery

The main propelling machinery is a Shinko-Sulzer air-injection single-acting two stroke-cycle Diesel engine of type 6ST68, with six working cylinders of diameter 680 mm. and stroke 1,200 mm., and develops 3,200 b.h.p. at 110 r.p.m., while at 15% overload the output is 3,680 b.h.p. at 115.4 r.p.m.

The engine was entirely built and supplied by the Kobe Steel Works, Ltd., and certain improvements were executed to the original design of Sulzer Bros. & Cie.

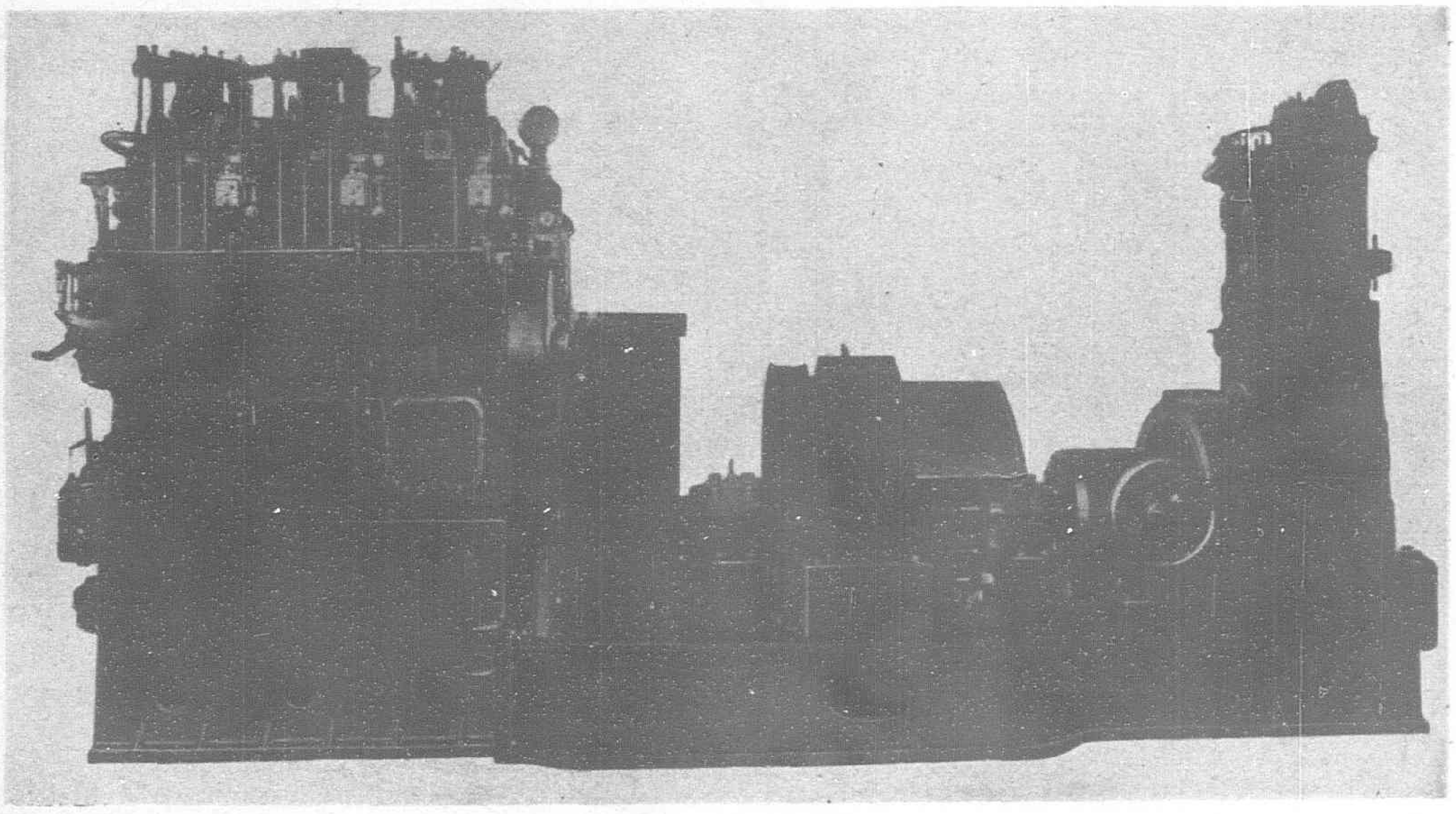
The injection air compressor is of a three stage type directly connected to the main engine at its fore end, and consists of a H.P. cylinder (150 mm., diam.), a I. P. cylinder (750 - 480 mm., diams.) and a L.P. cylinder (the upper 570-150 mm., the lower 570-130 mm.), all with a stroke of 600 mm.

There is a Servo-motor of 10 h.p. at 1,500 r.p.m.

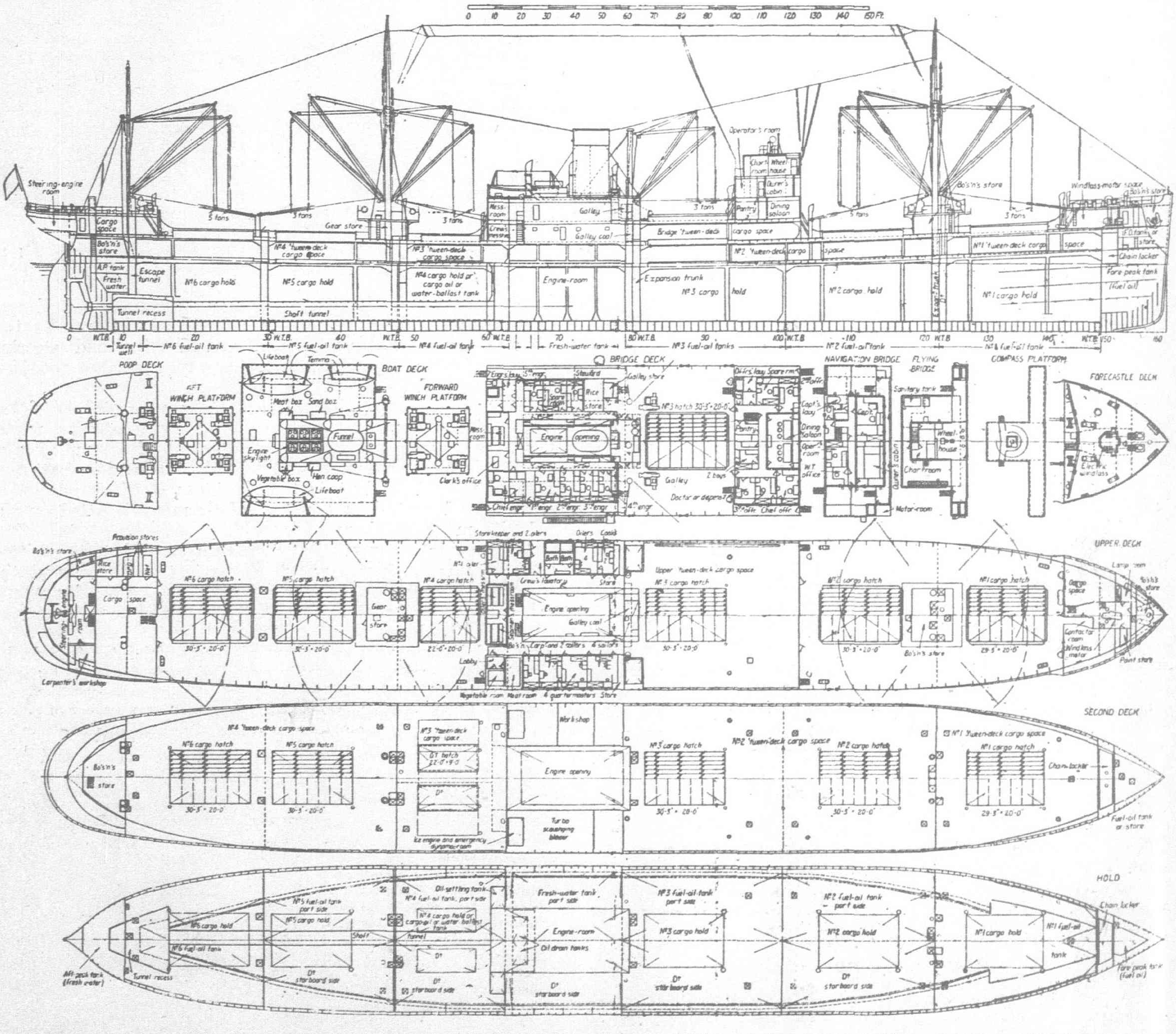
The air stowage comprises one injection air bottle of 150 litres at 75 kgs. per sq. cm., eight starting air bottles of 800 litres each at 75 kgs. per sq. cm. and a low pressure air reservoir of 7,000 litres at 32 kgs. per sq. cm.

A Brown-Boveri's turbo-blower of VD901 type is installed to supply scavenging air to the main engine, its capacity being 450 cub. meters per min. at a pressure of 0.125 kgs. per sq. cm.

The cooling of the cylinders of the main engine and



Generating Set of the "Soyo Maru"



General arrangement and machinery arrangement of the "Soyo Maru" built by the Asano Shipbuilding Co., Ltd. of Yokohama and engined by the Kobe Steel Works, Ltd.

air compressor is effected by sea water, whilst the pistons are cooled by fresh water. Principal rubbing parts of the engine are forced-lubricated. For these purposes, there are two sets of Sulzer's horizontal centrifugal cylinder-cooling water pumps of 140 cub. m. per hour at 2 kgs. per sq. cm., two sets of Sulzer's piston-cooling water pumps of the same type with a capacity of 40 cb. m. per hour at 4 kgs. per sq. cm. and two sets of Neidig lubricating oil pumps of a horizontal gear type with capacities of 25 cub. m. per hour at 4 kgs. per sq. cm. for the bearing-lubrication and of 33 cub. m. per hour at 20 kgs. per sq. cm. for the cross head lubrication. Further, two sets of cooling-water cooler, one lubricating-oil cooler and independent electric pumps are provided.

The main improvement carried out specially to this engine are as follows :—

1. The usual complaint for the vibration of the six cylinder engine with one directly connected air compressor has been totally eliminated after the careful design and cautious balancing, and it was proved that the engine runs very smoothly even at 15% overload. Consequently, the total length and weight of the engine were significantly reduced.
2. The usual practice of casting the injection valve seat and box together was given up, and these were separately made in order to reduce the expense of renewing both in case of trouble in one part.
3. The distance of adjacent packing rings of pistons was increased by 2 or 3 mm. in accordance with going upwards and the top ring was lowered as far as practicable from the piston head in order to avoid the excessive heat effect and to eliminate the breakability of the top ring.
4. Various improvements on the control devices and cooling devices.

Electric Generating Plant

There are three sets of 115 kw. main Diesel generators and one 7 kw. emergency generator, combined with air compressors.

The driving engines of the main generators are of the Shinko-Hesselman airless injection single-acting four stroke-cycle 3V29 type ; each having three cylinders of 290 mm. in diam., and 430 mm. of stroke, developing 175 b.h.p. at 334 r.p.m. The dynamos are of a D.C. compound wound open drip-proof type with an output of 115 kw. at 230 volts at 335 r.p.m. There are two sets of auxiliary air compressors directly connected to the main generators (one of three generators has no compressor) ; these are of Sulzer's vertical three stage C34 type, each having a H.P. cylinder of 75 mm. in diam., a I.P. cylinder of 340-295 mm., a L.P. cylinder of 340-750 mm. and a stroke of 180 mm., with a capacity of 225 cb. m. per hour at 75 kgs. per sq. cm. The Diesel engines were designed and manufactured by the Kobe Steel Works and the dynamos were supplied by Fuji Electric Machinery Manufacturing Co., Ltd., whilst the compressors are of Sulzer's design but improved by the Kobe Steel Works.

The emergency generating set comprises a Sulzer's MC12 type heavy oil engine with air compressor cylinders casted in and a dynamo is directly coupled to them. The engine cylinder has a diameter of 200 mm., a stroke of 240 mm. and an output of 12 b.h.p. at 450 r.p.m., while the air compressor is of two stage type with a H.P. cylinder of 45 mm. and a L.P. cylinder of 140-145 mm., the capacity being 28.8 cub. meters per hour at 75 kgs. per sq. cm. The dynamo is of Brown-Boveri's D.C. compound wound open drip-proof type with an output of 7 kw. at 230 volts.

Steam Generating Plant

A marine cylindrical donkey boiler of 5-in. 6-ft. in diameter and 6-ft. 6-in. in length at 100 lb. of working pressure is installed in a small boiler room at the port forward corner of the engine room. One auxiliary condenser, two feed water pumps, one steam injector, a complete oil burning set and other necessary accessories are provided.

Electric Pumps, etc.

A part of the forementioned, the following electrically driven auxiliaries are installed in the engine room :—

1—Fuel oil transfer pump of a gear type, 30 cb. m. per hour.
1—Fuel oil service pump of the same type, 6 cb. m. per hour.
1—Lubricating oil transfer pump of the same type, 2 cb. m./hr.
1—Fresh water pump of single acting vertical compound type, 6 cb. m. per hour.
1—Bilge pump of double acting vertical compound type, 50 cb. m. per hour.
1—Ballast pump of the same type, 200 cb. m. per hour.
1—General service pump of the same type, 100 cb. m. per hour.
1—Sharple's oil purifier, 200 gals. per hour.
1—Exhaust fan to the engine room, 3 h.p.

Further, necessary machine tools such as lathe, drilling machine, grinder, vices, etc. are provided in the engineers' workshop and store on the second deck.

Propellers

The propeller is of a four-bladed variable pith type with a diam. of 15-ft. 6-in., developed area of 70 sq. ft. and a mean pitch of 12-ft. 11-in.

RESULTS OF TRIALS

Date of Trials	*January 8, 1931*	*January 10, 1931*
Place of Trials	Off Tateyama, Tokyo Bay.	Off Tsurumi, Tokyo Bay.
Distance of mileposts	1 mile	½ mile
Draught, fore.	5′-6¼″	5′-6½″
aft.	15′-2½″	15′-2″
mean.	10′-4⅜″	10′-4¼″
Corresp. Displacement		4,850.0 tons.
Area of midship section		557 sq. ft.

Weather		*Cloudy*		*Cloudy*	
Kind of trials.	*Overload.*	*Full load.*	*¾ load.*	*½ load.*	*¼ load.*
Speed in knots	15.4115	14.779	13.344	9.942	7.939
R. P. M.	119	113	103	90	73
I. H. P.	4,517.5	3,894	3,050	1,905	1,000
B. H. P.	3,840	3,310	2,539	1,620	850
*Fuel consumption Grams per b.h.p./hr. ..	178	168	164.5	160	176

N. B. *Fuel consumption included auxiliaries.
Fuel used is Rising Sun Petroleum Co.'s "White Anchor."
Calorific value, 10,556 B.T.U.

Water-Tube Boilers in some Recent Merchant Ships with Service Results

(Continued from page 433).

building for their North Atlantic service have not yet been released for publication, it may be of interest to state that the design of the high-pressure water-tube boilers is of the Yarrow type. The boilers for the new Italian liner building for the Lloyd Sabaudo Company are also of this type. Whilst no details can yet be given, the design for these vessels is generally similar to the boilers of the *Empress of Britain* and of the *Strathnaver* and *Strathaird*.

Apart altogether from the increased thermal advantage of high-pressure steam, the saving in space and weight by the adoption of water-tube boilers is of great benefit to the naval architect. That reliability and high overall efficiency can be maintained in service with water-tube boilers has now been established, and indications point to low upkeep costs. In view of these facts the adoption of water-tube boilers in many different types of steamships is likely to be increasingly rapid, and further developments will be followed with interest.

TABLE III.

Vessel.	*Duchess of Richmond.*	*Duchess of York*	*Beaver-burn.*	*Viceroy of India.*
In service .. .. Over	2 years	2 years	3 years	2 years
Number of boilers	6	6	4	6
Average costs per annum (£):—				
Boiler pressure parts . ..	4	6	3	1
Superheater pressure parts .	59	—	31	14
Mountings (includes opening up for survey)	256	322	63	202
Brickwork	155	250	95	170
Casings	36	64	53	98
Insulation	4	2	8	24
General—fittings, etc. ..	9	20	13	5
Average total per annum ..	523	664	266	514
Average per boiler per annum, £	87	111	66	86

The New Excursion Motor Ship "Tennyo Maru"

For the Inland Sea Cruising in Japan. Equipped with Mitsubishi-Vickers Four-cycle, Solid-injection, Trunk-piston Diesel Engine

By *Y. TAJI, M.I.N.A., M.I. MAR. E.*

The beauty of the Inland Sea of Japan is unparalleled in its tranquil picturesqueness, and its charm remains as an everlasting memory to visitors to Japan. The *Tennyo Maru* (or the "Angel Ship") has been built by the Mitsubishi Kobe Dockyard to the order of the Setsuyo Shosen Kaisha, Ltd. for excursions on the Bay of Osaka and along its vicinal coasts. The vessel affords the utmost comfort and pleasure of passengers.

The vessel was laid down in August, 1930, launched in December, 1930, and completed in February, 1931.

The Principal particulars are as follows :—

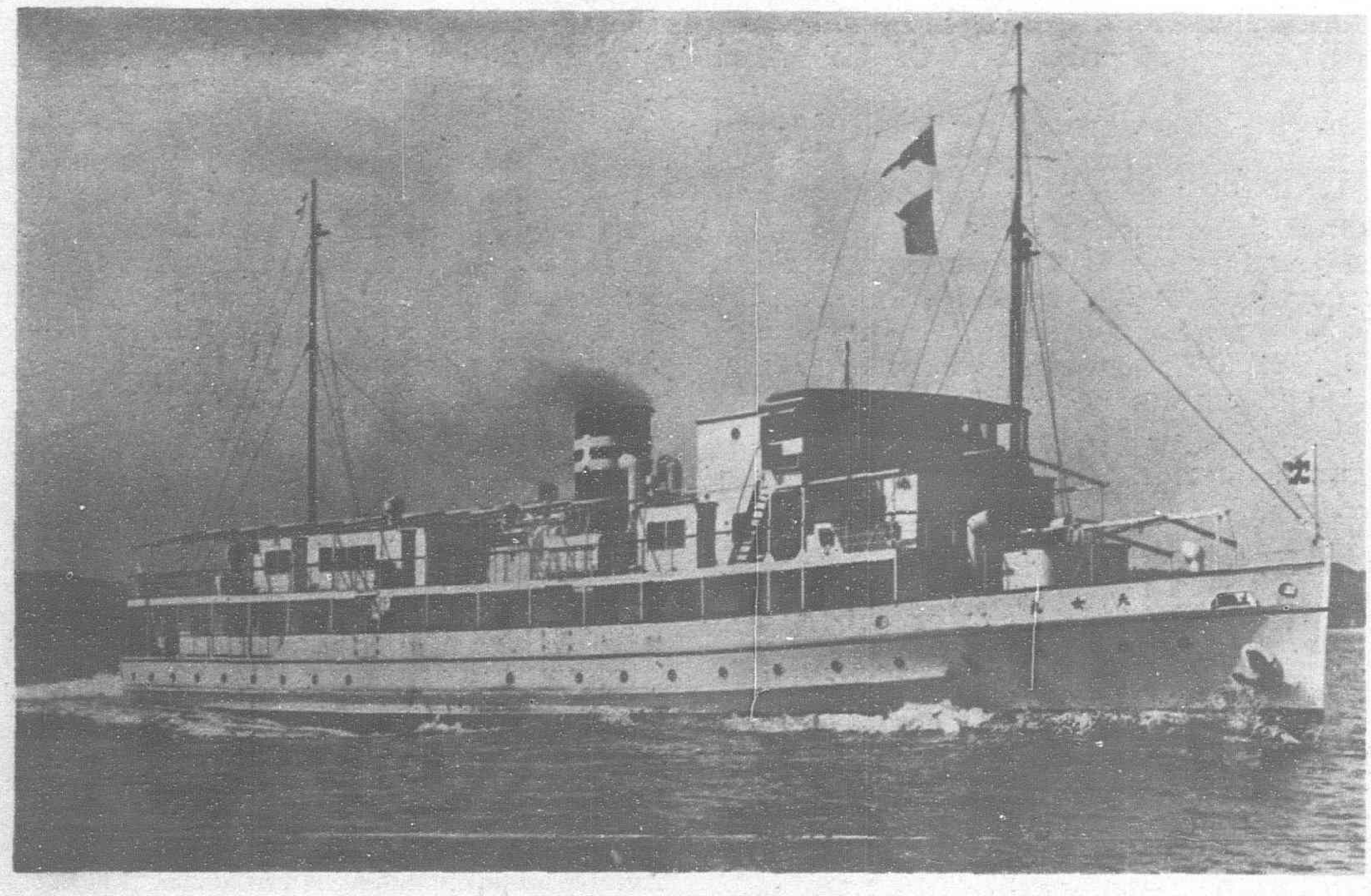
Length over all	166 ft. 6 in.
Length between perpendiculars	160 ,, 0 ,,
Breadth moulded	27 ,, 0 ,,
Depth moulded	12 ,, 9 ,,
Gross tonnage	495 tons
Mean trial speed	14.81 knots
Ditto b.h.p.	830

Number of passengers :—

First class	20	Special class
Second class	117	
Third class	494	Popular class
Total	631	

Propelling machinery :—

One set of Mitsubishi-Vickers four cycle, solid injection, trunk piston Diesel engine of type RG6, with a normal output of 700 b.h.p. at 240 r.p.m.



The "Tennyo Maru" on Trial

General Arrangement

For the pleasure cruising purpose, the vessel is designed to be beautiful in appearance and comfortable in accommodation.

The stem is of a raked straight type and the stern is of a destroyer type with a rectangular immersed rudder. The hull is subdivided into six water tight compartments by five transverse bulkheads, and the engine room is arranged amidships. There are a large dumpy funnel of a stream line shape on the top of engine room opening and two signal masts at fore and aft of the ship.

On the upper deck are the forward, middle and aftward deck houses. The forward house comprises a first class special Japanese room, a toilet room, lavatories, an enquiry office, a souvenir shop and a post office, whilst the chief engineer's room, a ship's galley, baths, third class lavatories, etc. are arranged around the engine casing amidships, and the aftward deck house is for a spacious third class passengers' room, pantry and cooks' cabin.

On the promenade deck forward are the first class family rooms of European and Japanese style, whilst the aft deck house is utilized for a large dining saloon, a pantry and a shop.

The navigation bridge is arranged over the fore deck house, where a wheel house, the captain's room, chief officer's cabin, etc. are situated.

The forward part of the second deck is for the crew's compartment and a large third class waiting room of European style, while abaft the engine room is a spacious third class waiting room of Japanese style, the stern part being utilized for a hand steering gear room.

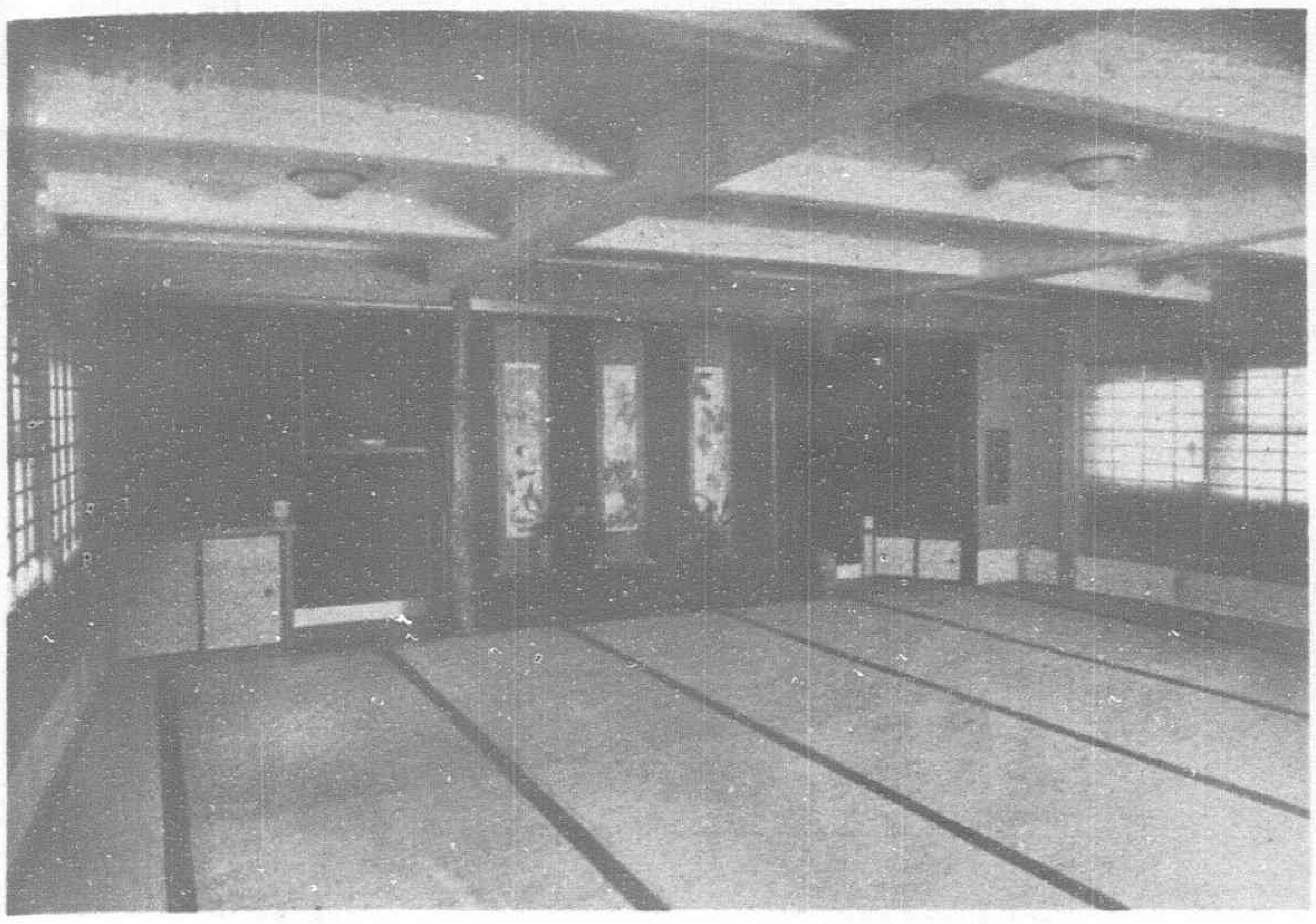
Passengers' Accommodation

Special care has been taken to ensure the passengers' satisfaction in the design, decoration and equipments of the private and public rooms as well as in the accommodation.

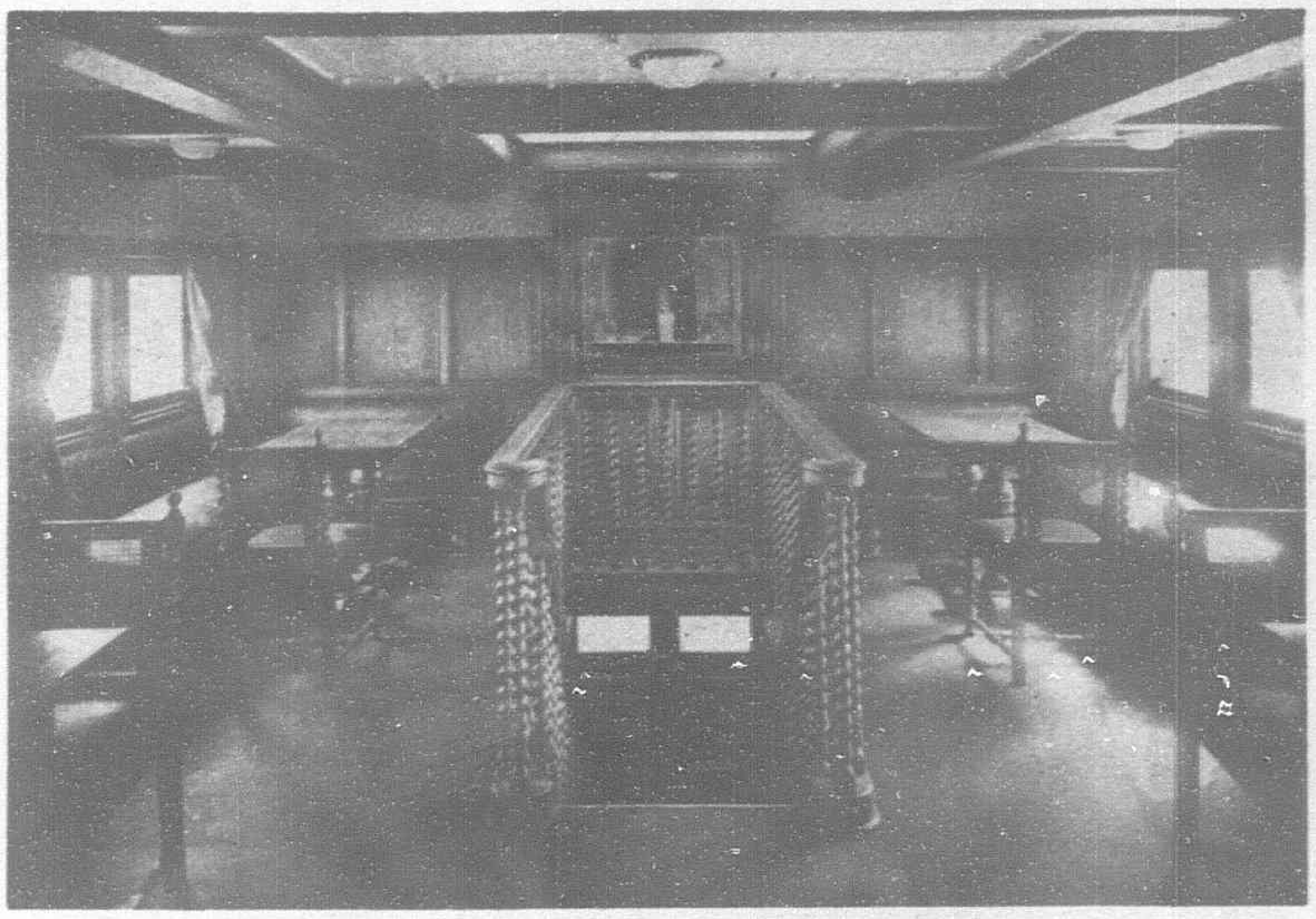
The forward first class waiting room on the upper deck is in the pure Japanese style with an alcove ("Toko") on the front and ornament shelves ("Chigaidana") at sides, while the floor is laid with Japanese mats ("Tatami") covered by carpets, so that the room is neat and dainty under the traditional simplicity of the Japanese decoration system.

The special toilet room is laid with "tatami" in one part, where a large looking-glass of Japanese type is placed for the convenience of ladies' dressing-up the "Kimono."

Ascending the grand staircase to the promenade deck, there is a large European room decorated in the Jacobean style and accommodated as a smoking room. The central skylight is set with beautiful stained glass showing a figure of the "Maiden from Heaven" or "Tennyo" in accordance with a



Special class Japanese room on Upper Deck



Jacobean style Smoking room, Promenade Deck

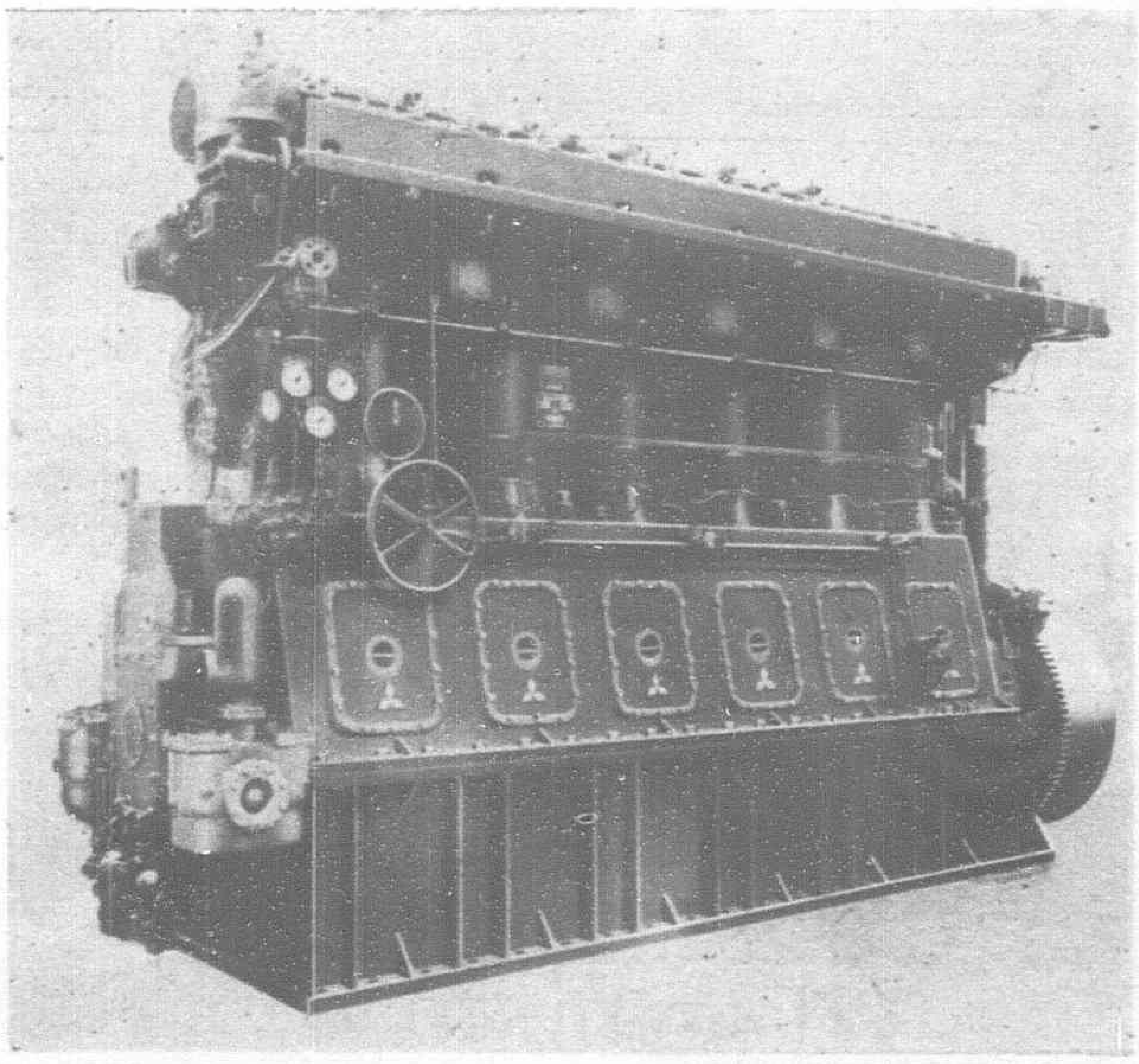
Japanese tradition, to which the name of the ship is related. An elegant mantelpiece and a mirror of tasteful design are arranged to the aft wall center, so that the room renders a pleasing composure to the passengers.

The special rooms in the front of the smoking room are arranged in both sides of the ship, two in the European style and the others in the Japanese style. The European special rooms are elegantly decorated and well lighted, provided with a large sofa, a table, comfortable chairs, etc. and are used as the first class family's rooms together with the Japanese special rooms. The Japanese special rooms comprise two compartments with central sliding doors between them, so that two rooms can be communicated in case of necessity. Each room has a decorative alcove and ornament shelves, the ceiling being lined with smoked cryptomerian boards and rattan woven sheets, whilst the floor is laid with light green "tatami" and the walls are plastered with decorative sands. Thus, the rooms are in the pure Japanese tea-room style.

The general dining saloon is in the modern French style with brilliant stained-glass skylights at center and the front wall is fitted with a beautiful sideboard, a large mirror, a decorative clock, etc., all being full of the modern lightsomeness.

The third class waiting room on the upper deck aft is a large Japanese room laid with "tatami;" having entrances at the fore and aft walls and large lift-up windows at sides, the passengers can enjoy the beautiful scenery while they are sitting on the floor. The third class room on the second deck aft is also laid with "tatami" and the surroundings are panelled at lower parts; being provided with large stairways at the fore and aft, passengers can easily have access to the upper deck.

The forward third class room on the second deck is mainly in European style with comfortable sofas, while the aft part is laid with Japanese mats. Both the forward and aftward third class rooms are very spacious and every care has been taken for the lighting, ventilation and upholstering to ensure the comfort of passengers of this popular class.



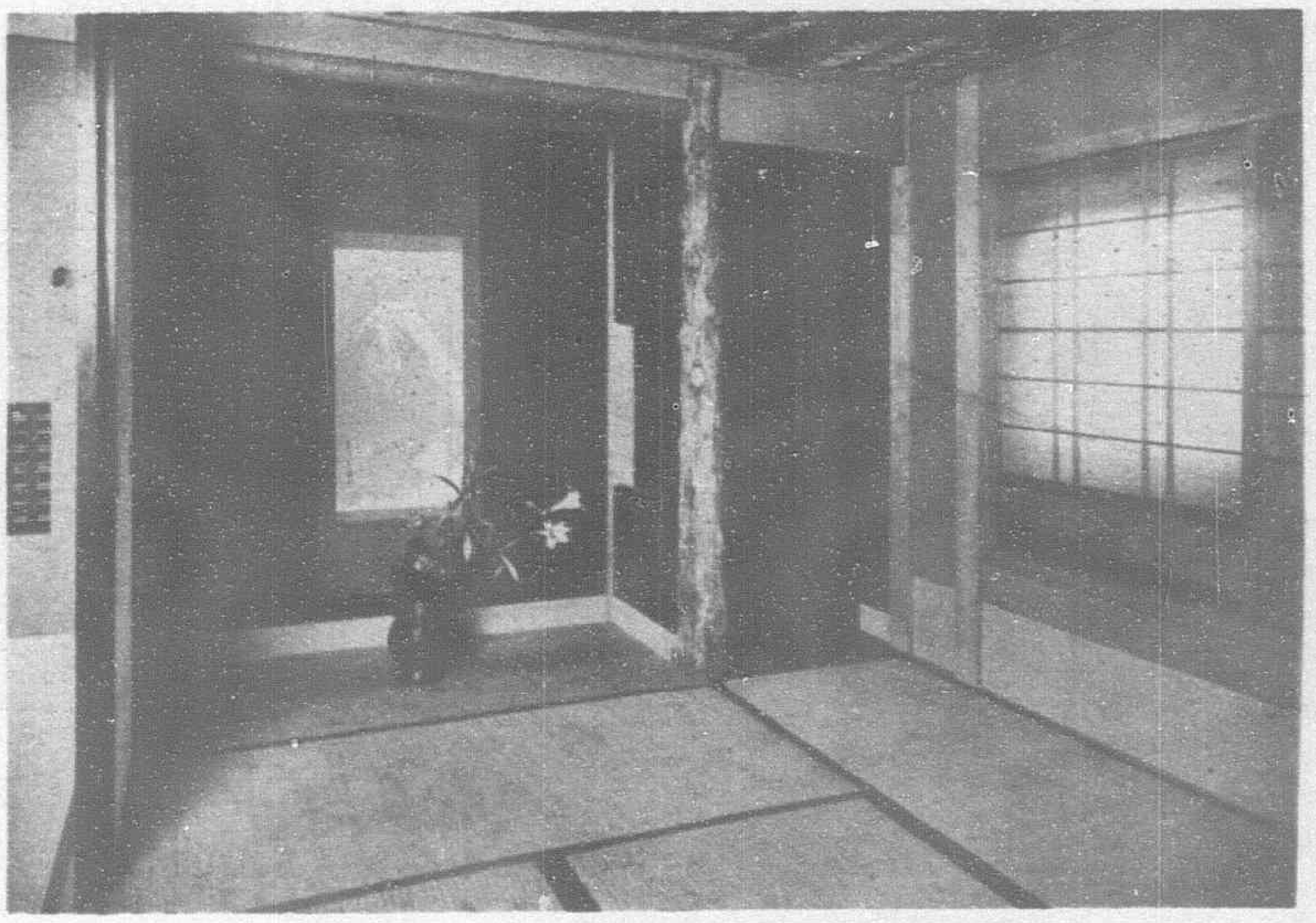
Main Engine of the "Tennyo Maru"

Deck Machinery, Etc.

All deck machinery and the lighting system of the ship are electrical, for that two sets of 15 kw. generators are provided.

An electric windlass and a capstan are installed at the bow and stern, and every room is fitted with electric fans, whilst the funnel and masts have illumination devices for the ship's decoration at night.

Dining Saloon, Promenade Deck



Special class Japanese Family room, Promenade Deck

Main Engine and Auxiliaries

The main propelling machinery is one set of the Mitsubishi-Vickers four cycle, airless injection, trunk piston Diesel engine of type RG6, with six cylinders of 400 mm. in bore and 600 mm. in stroke, developing normally 700 b.h.p. at 240 r.p.m.

In the official measured mile trials, a mean overload output of 831 b.h.p. was acquired at 266 r.p.m.

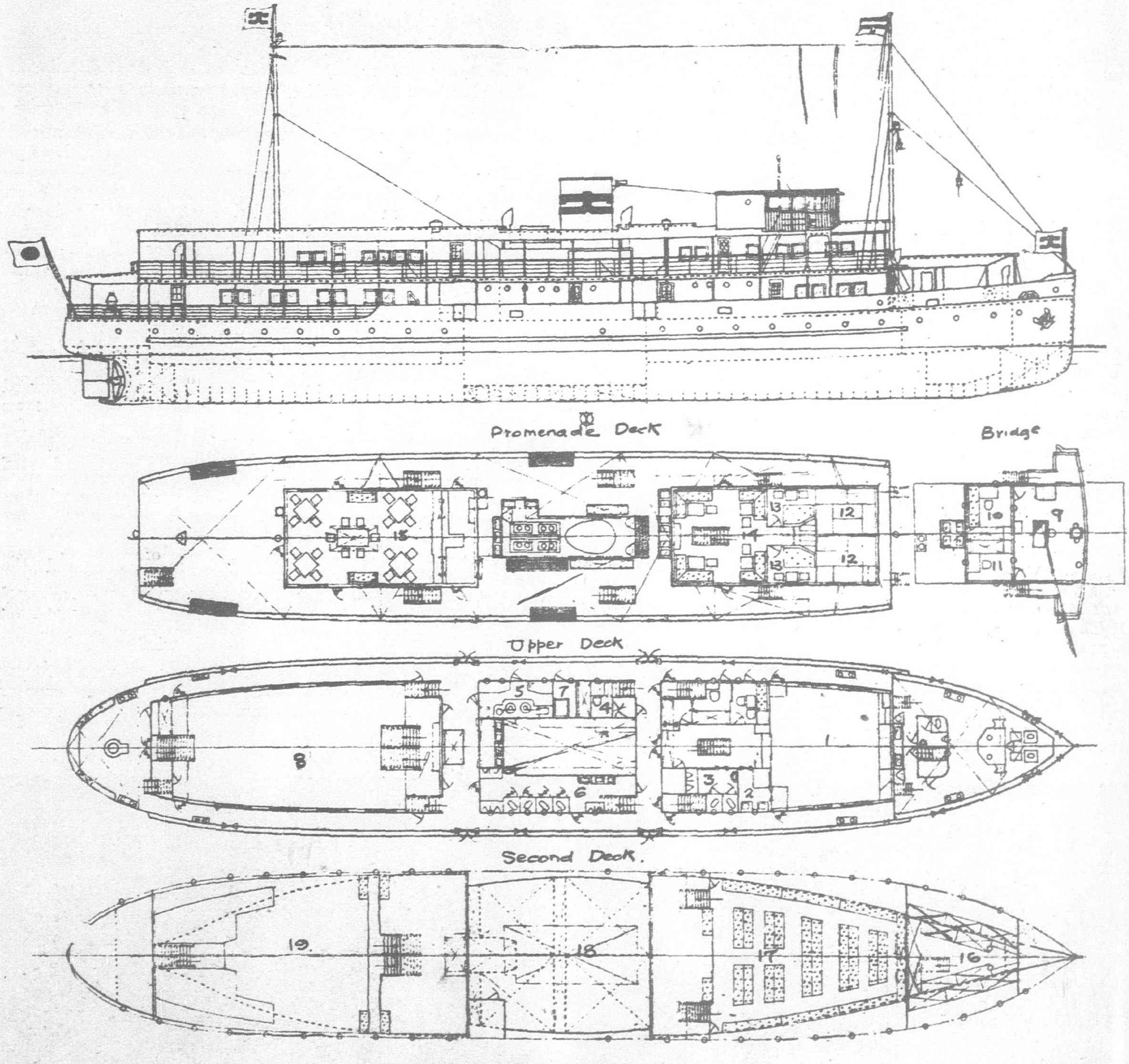
The engine was designed and constructed under many years' experience and skill of the Mitsubishi Kobe Works, and it is claimed for the easy handling, superior efficiency, robust construction and excellent workmanship.

The fuel oil injection device is of the famous Vickers' solid injection system with a minimum number of fuel pumps, which enables easy adjustment of the fuel injection pressure, and also annihilates troubles in the fuelling system as well as holding a high thermal efficiency in a large scope of the variation of revolutions and output. As shewn in the table and curves attached, the variation of the fuel consumption from 10% overload to a half load is only 169 grams to 172 grams.

A special design was applied to this engine for the shape of combustion chambers and the direction of injection, so that the result of combustion has been splendid and exhaust gas has been utterly smokeless at any load.

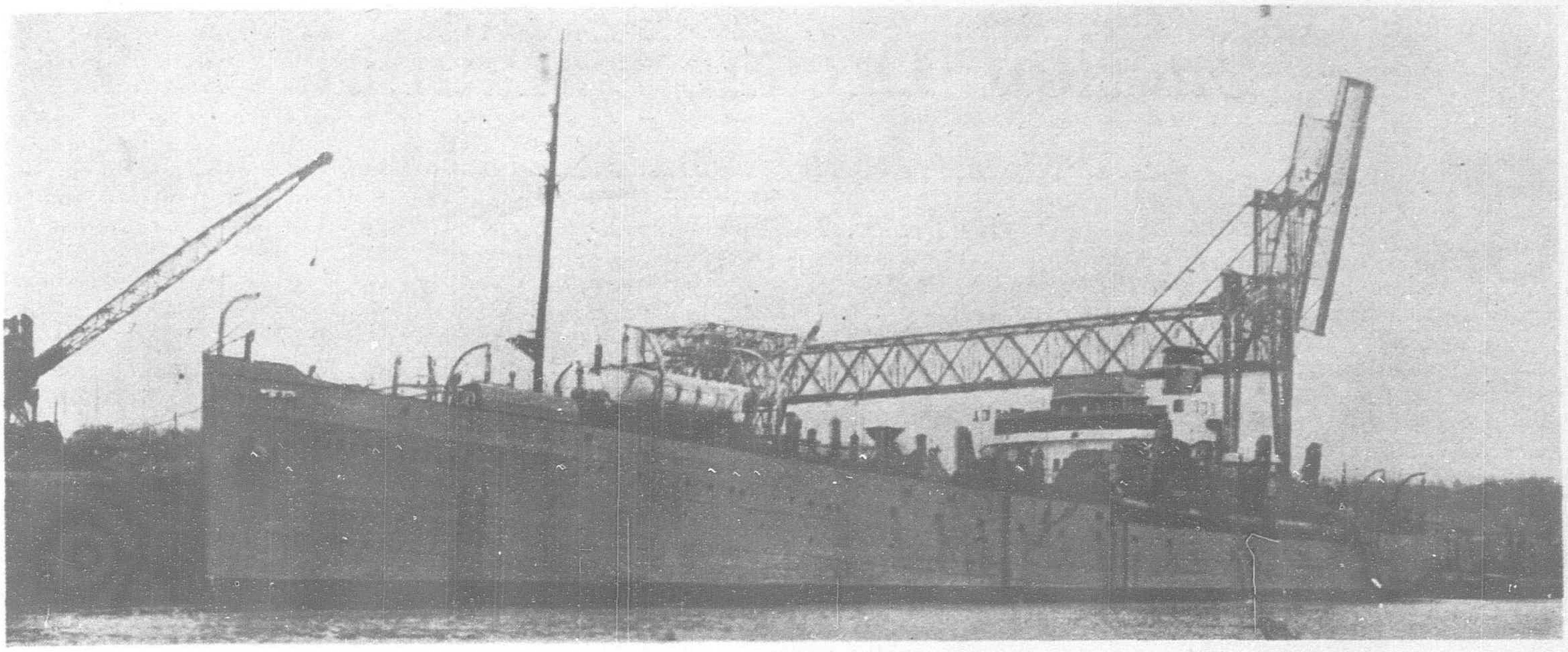
The Mitsubishi patent oil-wiping piston rings with two peripheral projections are fitted to the piston packings in order to reduce the lubricating oil consumption.

(Continued on page 447).



General Arrangement "Tennyo Maru"

1. Special class Japanese room.
2. Toilet room.
3. Lavatory.
4. Chief engineer.
5. Galley.
6. Third class lavatory and W.Cs.
7. Japanese bath.
8. Third class waiting room.
9. Wheel house.
10. Captain's room.
11. Chief officer's room.
12. Family room, Japanese style.
13. Family room Ditto. European style.
14. Special class smoking room.
15. General dining saloon.
16. Crew's compartment.
17. Third class European room.
18. Engine room.
19. Third class Japanese room.



The Dredger "Pierre Lefort" at Pier in Bordeaux

Diesel-Electric Suction Dredger "Pierre Lefort"

Built at the Bremen Yard of the Deschimag under the Dawes Plan for Service in the Port of Bordeaux—Fitted with M.A.N. Engines, the Electrical Equipment being by the Societe Als-Thom, Paris

THE authorities of the port of Bordeaux have recently taken delivery of the diesel-electric suction dredger *Pierre Lefort*, which has been built by the Deschimag at their Bremen yard under the Dawes plan. The principal dimensions are :—

Length	336 ft.
Breadth	54 ft.
Depth	26 ft.
Draught	19 ft. 3 in.
Speed, loaded	10 knots.

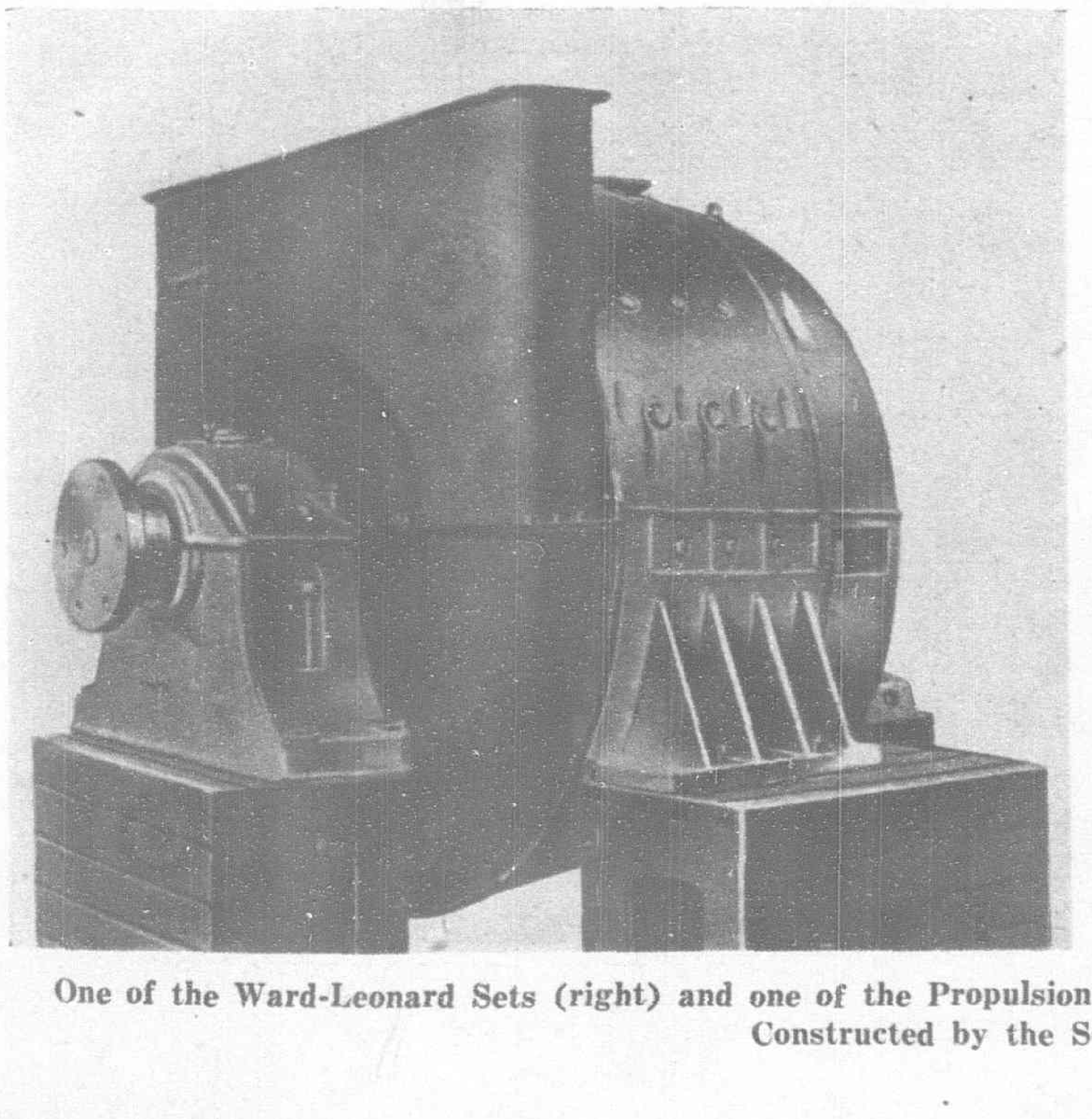
The vessel is fitted with two M.A.N. engines developing 2,400 b.h.p. and driving the propeller shafts through electrical transmission gearing, the same generators supplying the current to the dredging plant.

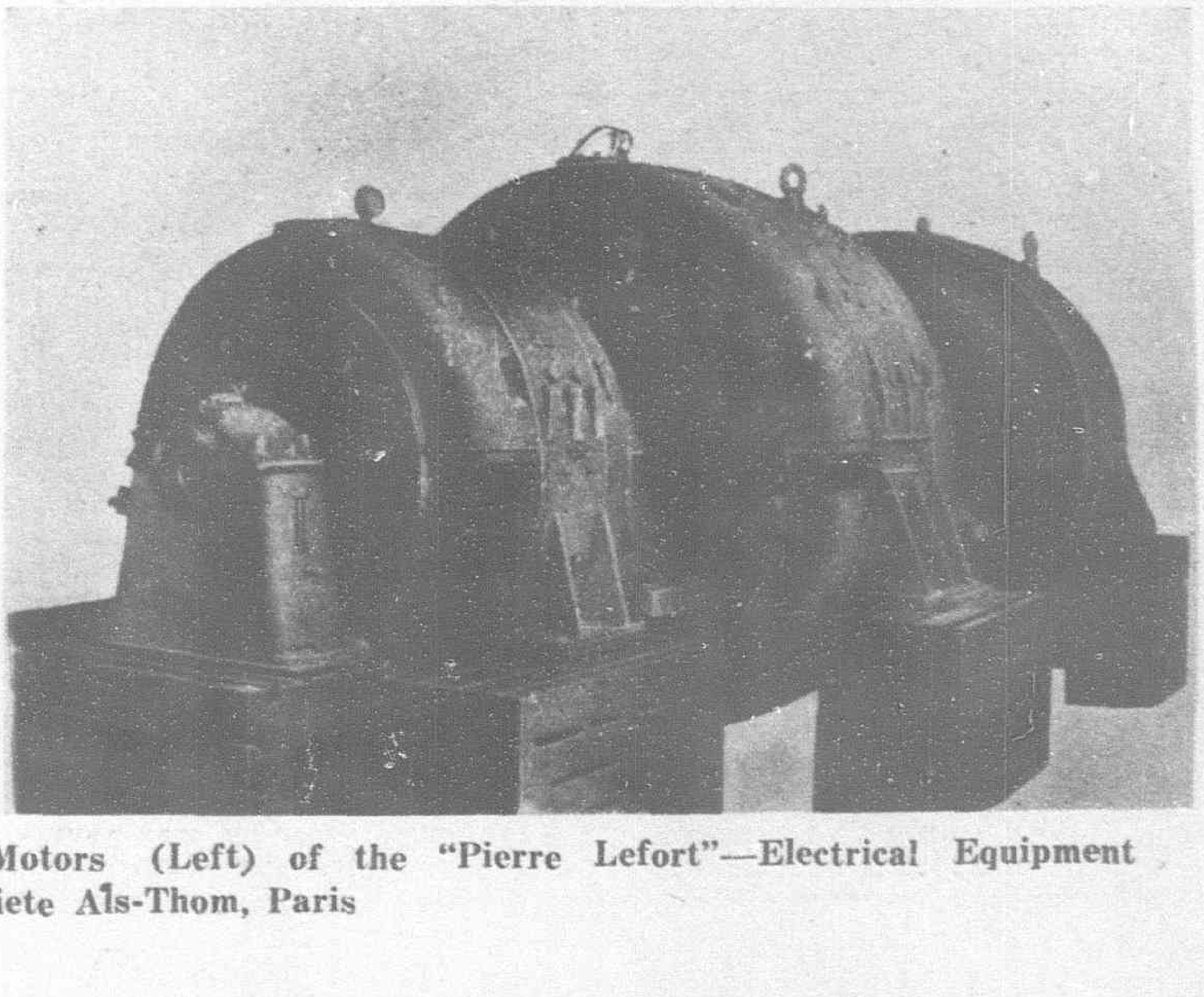
The electrical equipment was ordered from Siemens Schuckert-Werke, who sub-let the contract to the Société Als-Thom, Paris. The equipment includes two main alternating-current generating sets of 940 kw., at 170 r.p.m., the pressure being 525 volts ; two exciters of 190 kw., also running at 170 r.p.m., and having a pressure of 230 volts ; two alternating-current 525-volt motors of 1,140 s.h.p. each, running at 200 r.p.m.

Under normal conditions each main generating set drives the propeller on the corresponding side of the vessel, but for slow running the two motors can be driven by either of the two generators. It is also arranged that the electric motors of the dredging pumps can be driven from one of the main generators, these pump motors being controlled on the Ward-Leonard system.

The dredging work is carried out by means of two lateral suction pipes. The wells provided for the reception of the dredged material have a capacity of 2,000 cub. m., and can be filled with sand within an hour. Dredging by suction has already been experimentally tried by the Bordeaux authorities with the dredger *La Coubre*, and has proved very efficient.

The trials of the *Pierre Lefort*, which were carried out at the mouth of the River Gironde, have fully confirmed the efficiency and suitability of the electrical equipment fitted to this interesting vessel.





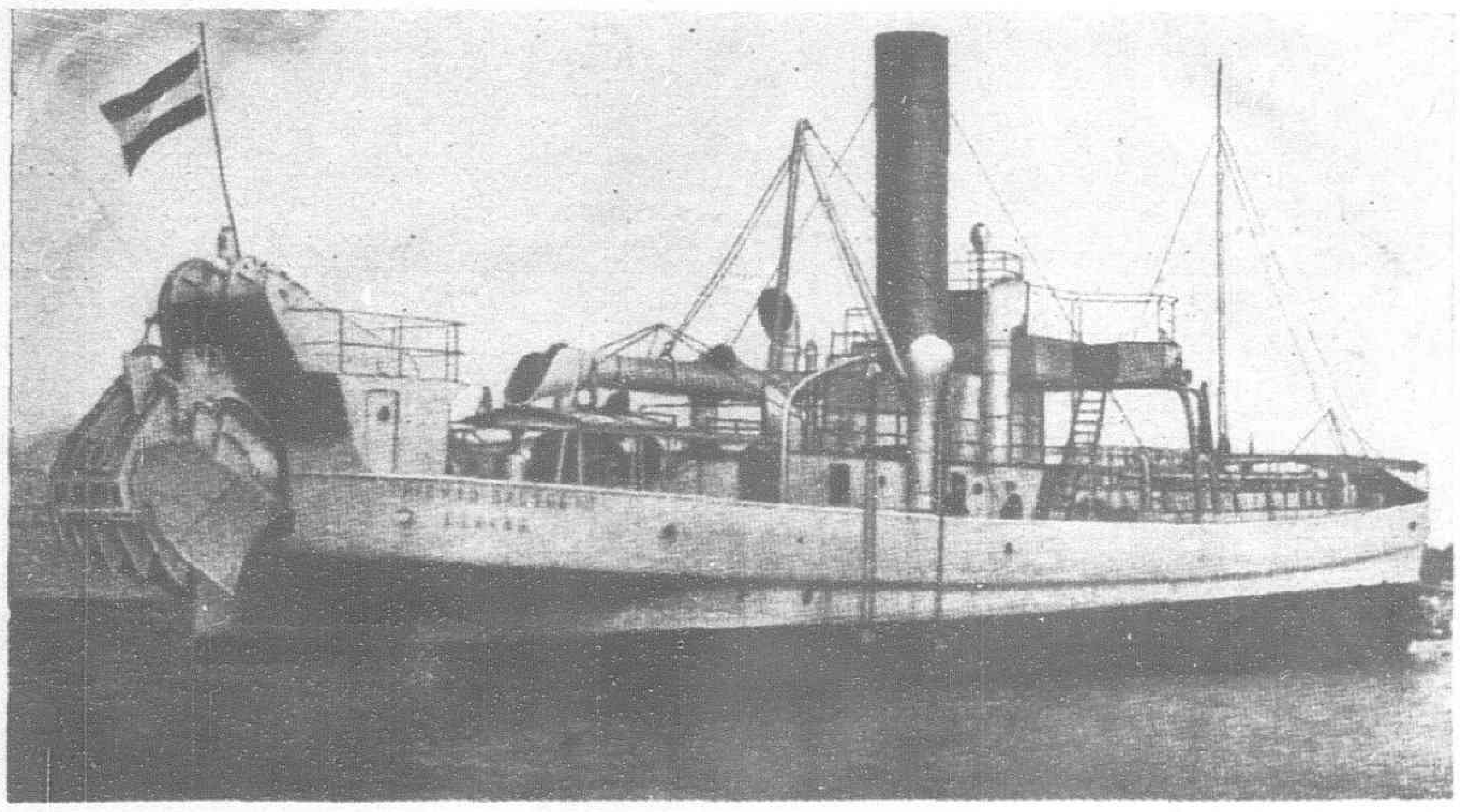
One of the Ward-Leonard Sets (right) and one of the Propulsion Motors (Left) of the "Pierre Lefort"—Electrical Equipment Constructed by the Societe Als-Thom, Paris

Suction Dredge "Manila"

Development of Modern Dredge Design

By Dr. W. THELE, Hamburg

Ever since 1903, when the first drag suction dredge with suction arrangement according to the Fruhling patents was delivered, Messrs. F. Schichau, G.m.b.H., of Elbing, specialists in the building of floating dredges since the first years of their existence, devoted themselves expressly to perfecting the suction dredge. By 1930, they had built and delivered 27 dredges of this kind, of a combined capacity of about 28,000 tons and a total power output of 26,000 indicated horsepower. A large proportion of these vessels, or 17 all told, were ordered by foreign governments or private firms. In the following, the design of draghead dredges and of anchor-spud, rotary-head dredges will be described in some detail.



Suction Dredge "Dredge Manila." Stern View of Vessel, Unloaded, with Head Raised. (See also Figs. 7 to 10)

Drag Suction Dredges

Like every other suction dredge which is not equipped with a special power-driven cutting device, dredges with the Fruhling drag are limited in regard to their application. This type of dredge is best suited to soft and specifically light material, such as silt and loose sand, because in such soils it is possible to employ a wide drag head capable of covering a large surface, and thereby giving a high degree of efficiency.

The specific advantage of the drag-type dredge is its independence from bow anchors, and its ability to work ahead by the power of its screws. Due to this fact, drag dredges are particularly adapted to use in narrow channels subject to heavy traffic, as well as in the open sea. A pre-requisite for this mode of working, however, is the provision of separate driving engines permitting independent operation of the screws and dredge pumps.

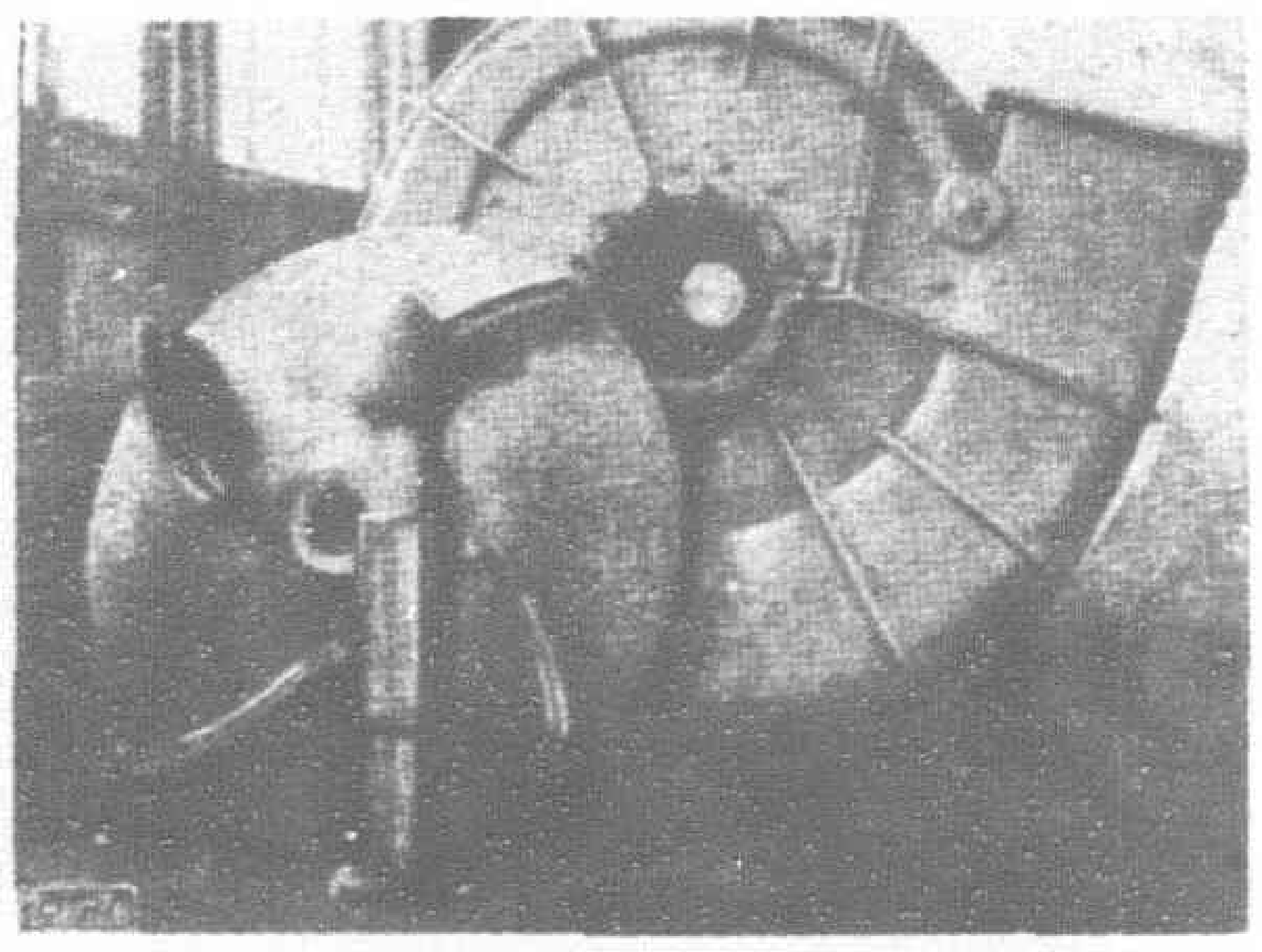


Fig. 6.—Cast-Steel Dredge Rump Behind: The spiral pump casing. In front: The impeller, open on the suction side, and the shaft

Cutter Suction Dredges

In clay and mar good results can be obtained neither with plain suction tubes nor with drag heads. While thin layers of these soils, such as are sometimes found bedded between strata of sand, constitute no obstacle, it is different in the case of a solid deposit of these materials. In that event, unless the advantages of suction dredging are to be foregone, it is necessary to employ special mechanical cutting devices or rotary cutters, which penetrate and break up the soil ahead of the suction tube. Since these rotary heads must be rigidly supported if they are to produce a uniform cut, they can be used only in suction dredges employing spud anchorage.

The Schichau Yard has taken up the construction of this type of dredge, which is lately being increasingly put into use, although only for work in quiet waters. Like bucket dredges, rotary-head suction dredges are suitable for every type of soil, and are of particular advantage when the dumping grounds are located in the vicinity of the dredging site, and the employment of a floating pipe line for carrying off the dredgings is therefore possible.

The Anchor-Spuds

Figs. 1 to 3 schematically illustrate the various methods of spud anchorage. With the first dredges of this type, represented in Fig. 1, two anchor-spuds were employed, the spuds being located at the stern of the vessel and movable in the vertical sense only. The dredge

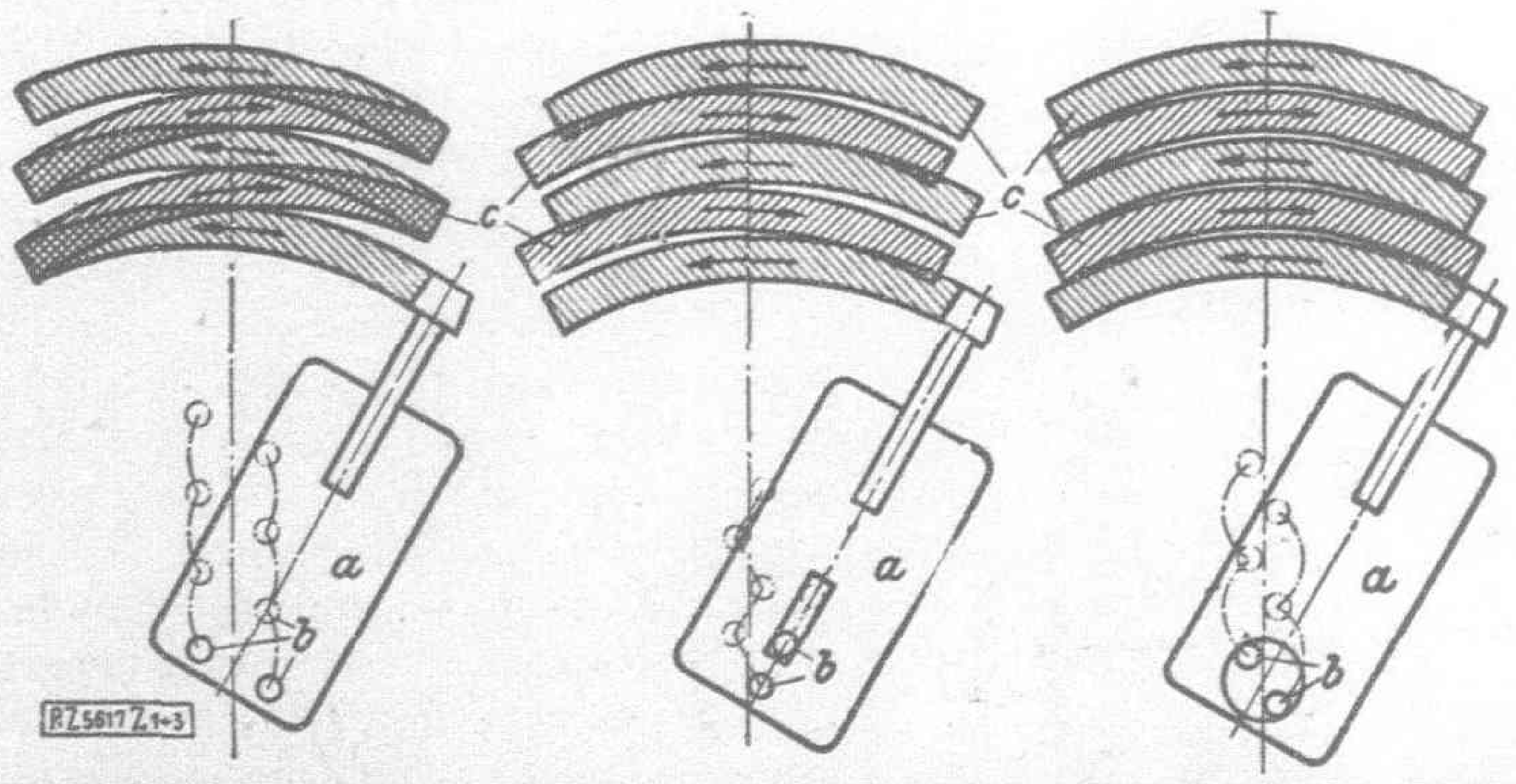


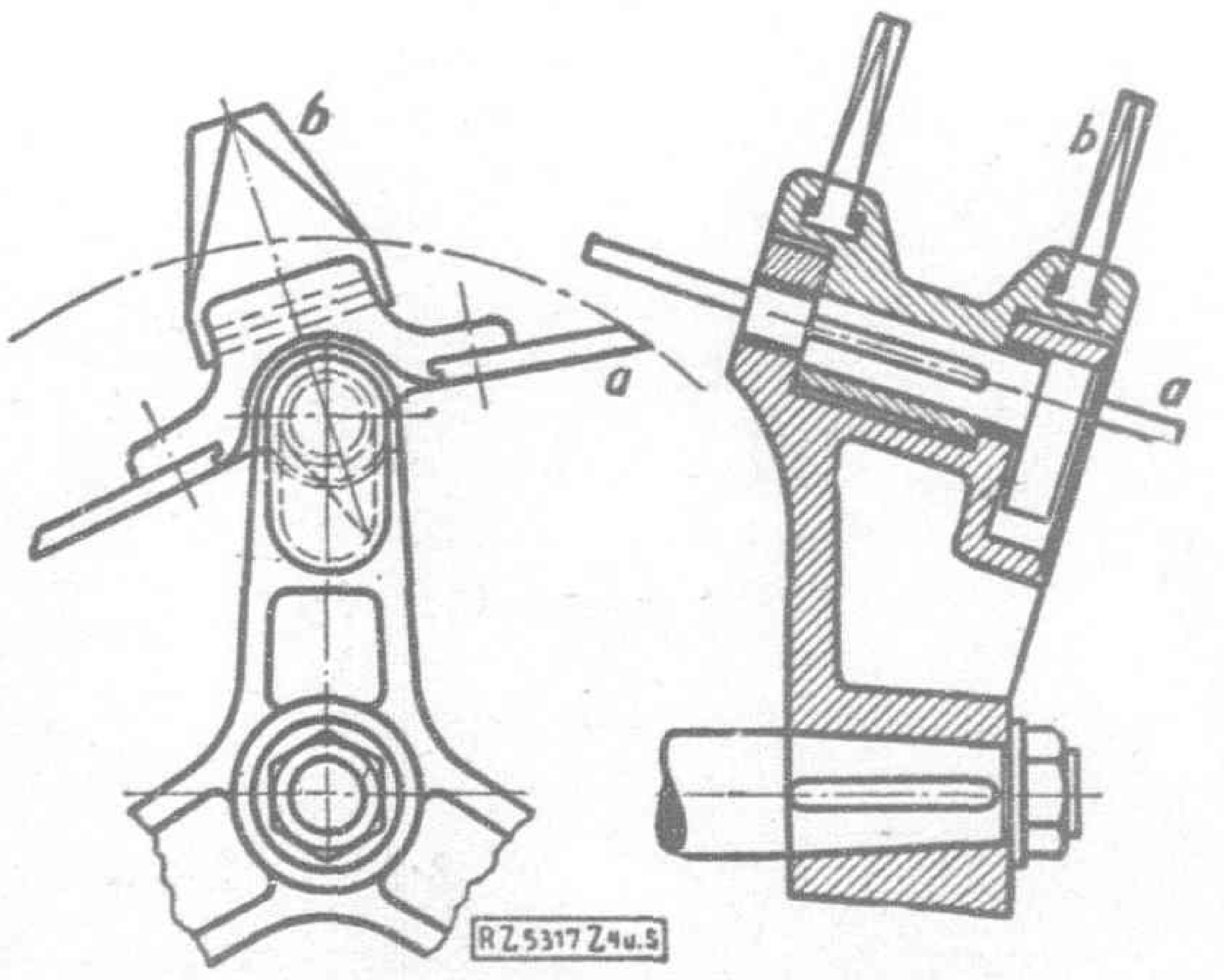
FIG. 1. CUTTER-HEAD SUCTION DREDGE OF OBSOLETE TYPE, WITH TWO LATERAL SPUDS

FIG. 2. CUTTER-HEAD SUCTION DREDGE WITH ONE PIVOTAL AND ONE FEEDING SPUD MOVABLE LENGTHWISE OF SHIP

FIG. 3. CUTTER-HEAD SUCTION DREDGE WITH SPUD CYLINDER AND AUXILIARY SUPPORT

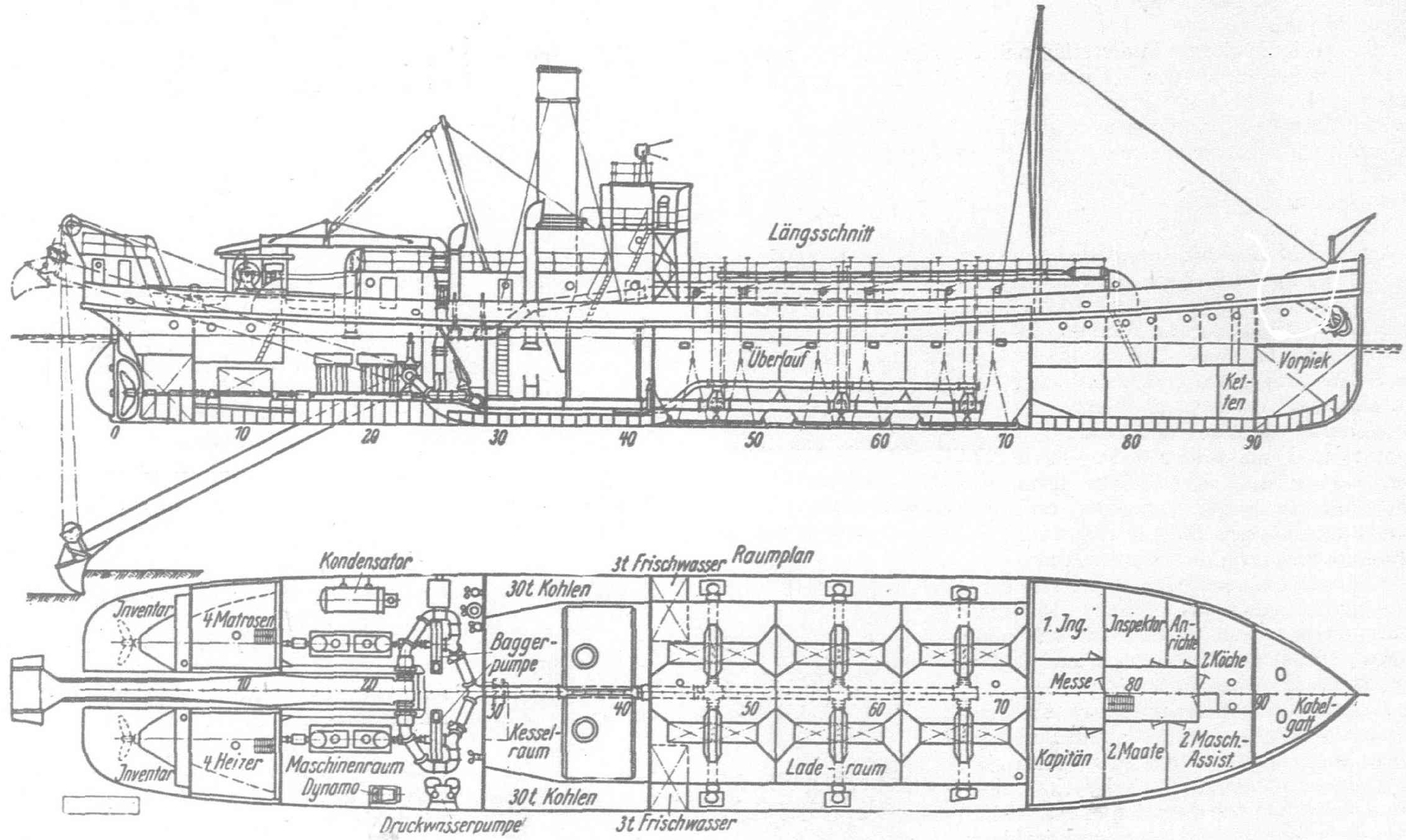
FIGS. 1 TO 3. SCHEMATIC REPRESENTATION OF THE FIELD COVERED BY THE CUTTER HEAD WITH DIFFERENT ARRANGEMENTS OF SPUDS

a, Dredge; b, Spuds; c, Working area.



FIGS. 4 AND 5. CUTTER HEAD WITH INTERCHANGEABLE MAIN AND AUXILIARY BLADES

a, Main blades; b, Auxiliary blades



Figs. 7 and 8.—Longitudinal Section and Plan of Suction Dredge "Dredge Manila"

Langsschnitt = Longitudinal section ;
Uberlauf = Overflow ;
Raumplan = Plan ;
Kondensator = Condenser ;
Frischwasser = Fresh water ;
Inventar = Stores ;
4 Matrosen = 4 sailors ;
4 Heizer = 4 stokers ;
Maschinenraum = Engine room ;
Dynamo = Dynamo ;
Druckwasserpumpe = Hydraulic pump ;
30 t Kohlen = 30 tons of coal ;
Baggerpumpe = Dredge pump ;
Kesselraum = Boiler room ;
Laderaum = Hold ;
1. Ing. = First Engineer ;
Messe = Mess ;
Kapitan = Captain ;
Inspektor = Inspector ;
2 Maaten = 2 Mates ;
Anrichte = Pantry ;
2 Koche = 2 Stewards ;
2 Masch-Assist. = 2 Assist. Eng. ;
Kabelgaff = Cable block.

was swung alternately around one or the other spud with the help of the two front-side anchors, thereby working itself forward in a manner roughly comparable to that of a person walking on stilts. The disadvantage of this method of dredging is that, due to the eccentricity of successive swings, the cuts largely overlap, with low efficiency as the inevitable result.

An improvement over this plan is the arrangement of Fig. 2, which is widely used to-day. By this method, the dredge swings always around the same spud, while the feed is effected by a second spud. To this end, the second spud is lowered into the river bottom and, after the first has been raised, is moved along a slot-shaped well, lengthwise of the ship, by means of a carriage. Although this method is a marked improvement over the first, the feed, which is best effected at the end of each swing, is but partially utilized in as far as the forward travel of the dredge is concerned. Moreover, successive swings are staggered, with accompanying evident drawbacks, which increase in proportion with the increasing angle through which the vessel is swung in dredging.

The third method, indicated in Fig. 3, avoids this last-mentioned trouble by accommodating both spuds in a vertical cylinder, which is rotatable in a corresponding circular well in the hull. By this arrangement, the cylinder acts as an eccentric. The feed may be varied as desired, and may be effected in any position of the vessel, while the axis of swing remains exactly on the center line of the area to be dredged. During the swinging of the ship, both spuds remain anchored in the bottom and hold the cylinder, which thus serves as the pivot for the vessel. By this procedure, the different cuts are added to each other so as to form a practically solid and even-sided depression. To avoid excessive diameters in the spuds, such as would otherwise be required to prevent springing in working at great depths, a dummy spud, also with vertical adjustment, is provided centrally of the cylinder. At its lower end, the dummy carries a cross-yoke with bearings in which the main spuds may be supported at any desired level.

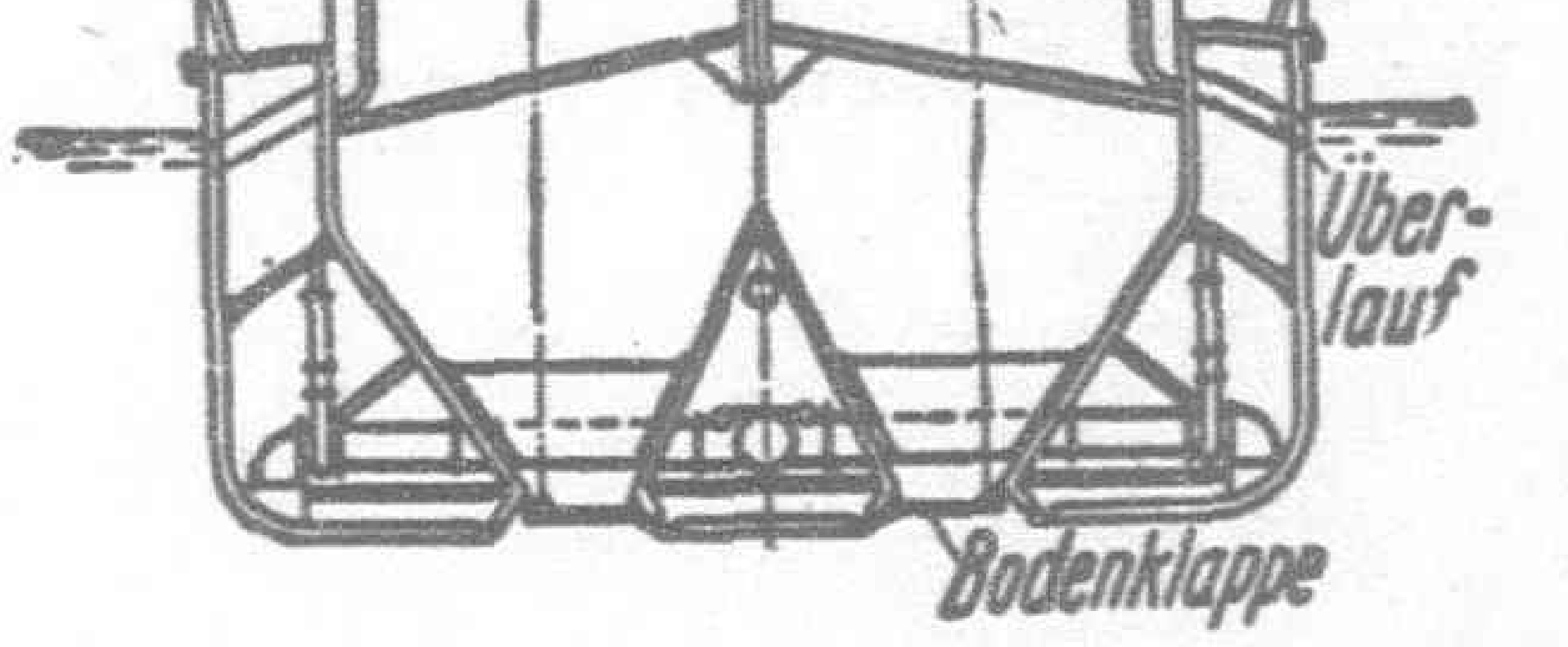


Fig. 9.—Transverse Section Through Hold

The spoil may be discharged either through two rows of bottom doors, or through a delivery pipe.
Uberlauf = overflow ;
Bodenklappe = Trap-door.

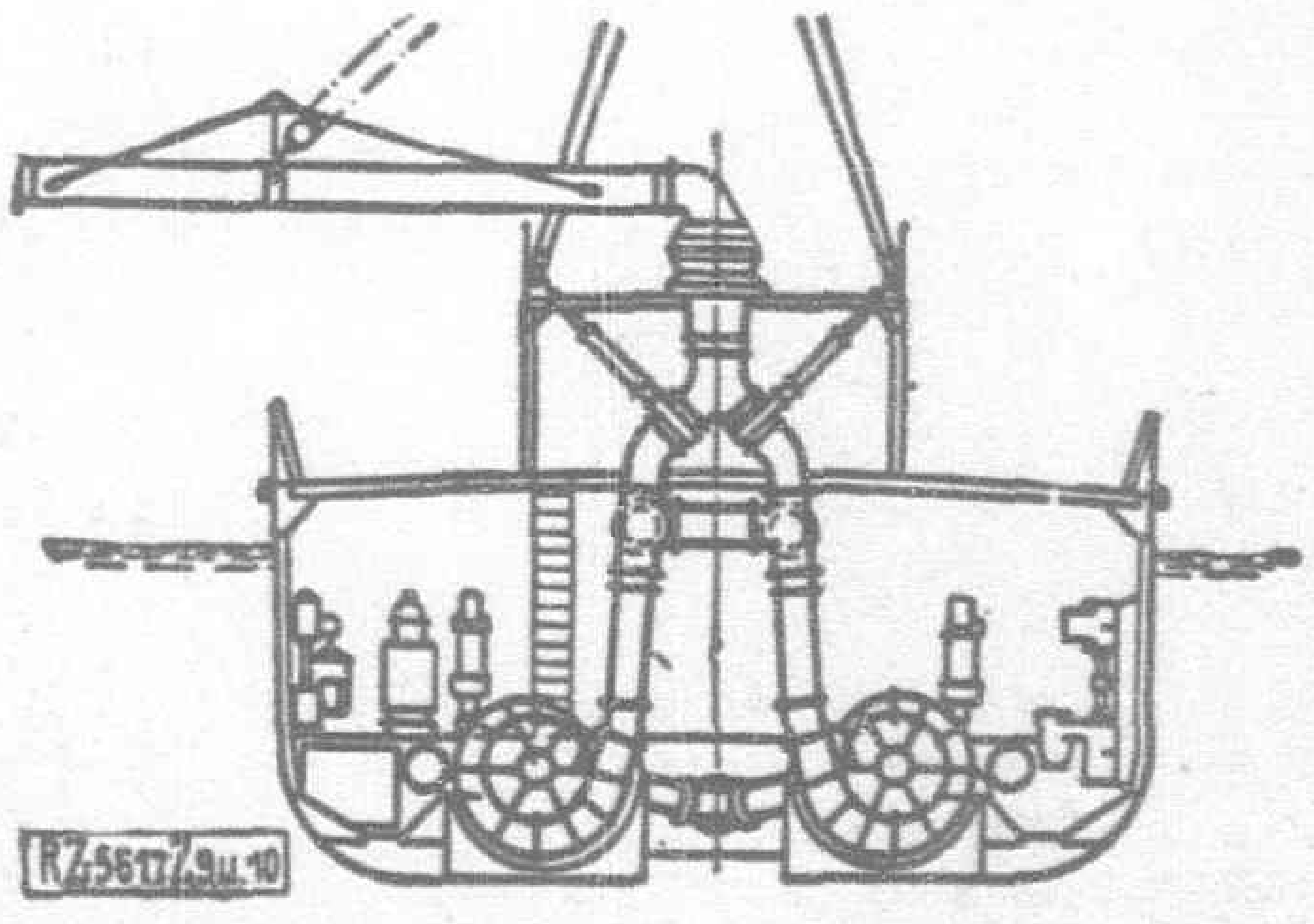


Fig. 10.—Transverse Section Through Engine Room at Frame No. 25, Showing the two Dredge Pumps

The Rotary Head

Rotary cutters of older types were capable of revolving only in one direction. This has proved a disadvantage, because the blades are bound to enter the soil from above during each alternate swing of the vessel. Inasmuch as a heavy cutting pressure is required for penetrating hard soil, this kind of action may easily result in causing the cutter head to spring up and roll over the soil.

To overcome this drawback, it is necessary to reverse the rotation of the head at each swing so as to cause the blades to cut always from below, in the same manner as a dredge bucket. So applied, the head is also better enabled to move obstacles such as boulders and logs, since it is easier for such objects to be lifted than to be forced into the soil. Since effective cutting calls for a certain definite and pronounced blade angle, it is necessary for the blades to be reversible and capable of being shifted to the correct position at each reversal of the cutter. This is best effected by automatic means and independently for each blade, to forestall the possibility of all blades being put out of commission if one should happen to jam.

The periodic change in direction and the simultaneous reversal of the blades, moreover, effectually prevents the clogging of the cutter head in sticky soil, which has been a drawback with former cutter designs.

The cutter-head construction developed and patented by the Schichau Yard on the basis of these principles, and of which a number have thus far been put into service, is shown in Figs. 4 and 5. The cutter hub has three radial arms, of which each carries a reversible two-way cutting blade. The blades proper are removably held in a cast steel carrier, which may be swung around a pivot and against a covered stop on either side. Each blade carrier has, in addition, from two to three smaller, radial, and interchangeable, auxiliary knives with edges placed at right angles to those of the main blades. These knives serve both for automatically shifting the main blades during, and holding them after, reversal, and aiding in the important task of properly breaking up the soil.

As practical experience shows, the combined action of the main and auxiliary blades reduces the soil into lumps of uniform size, which are easily carried out by the water-current flowing in the direction of the suction inlet. It would of course be inadvisable to cut up the soil more than is necessary for allowing the spoil to pass through the suction line. Indeed, any such further reduction would not only be superfluous and wasteful of power, but would be detrimental to the discharge of the dredgings at the dumping end. The cutter head described is suitable for all types of soil, special forms of blades being provided for very hard and rocky material. Depending upon the prevailing soil condition, the cutting speed varies from 25 to 50 m. (80 to 160 ft.) per minute. The width of cut or thickness of slice fluctuates between 8 and 15 cm. (3 and 6 in.).

The Dredge Pumps

A further main part of a suction dredge is the dredge pump. The Schichau firm has developed for its suction dredge a type of pump which has proved a complete success, combining as it does high efficiency with adequate operating dependability. A view of one of these pumps appears in Fig. 6. They are made almost throughout from cast steel, and, as will be noted from the illustration, have a spiral casing and a four-vaned impeller, which is open on the suction side. This design of impeller makes both for good efficiency, and for simplicity in the design of the pump, there being no need for a seal between the suction and delivery spaces, as is required with an impeller closed on both sides. The pump casing is of split design, to simplify replacement of the wear plates and removal of the impeller with its shaft and glands. The casing is divided in such a way as to avoid the need of disconnecting the suction and pressure lines to get at the pump. The impeller shaft is carried through the casing sealed against water and air.

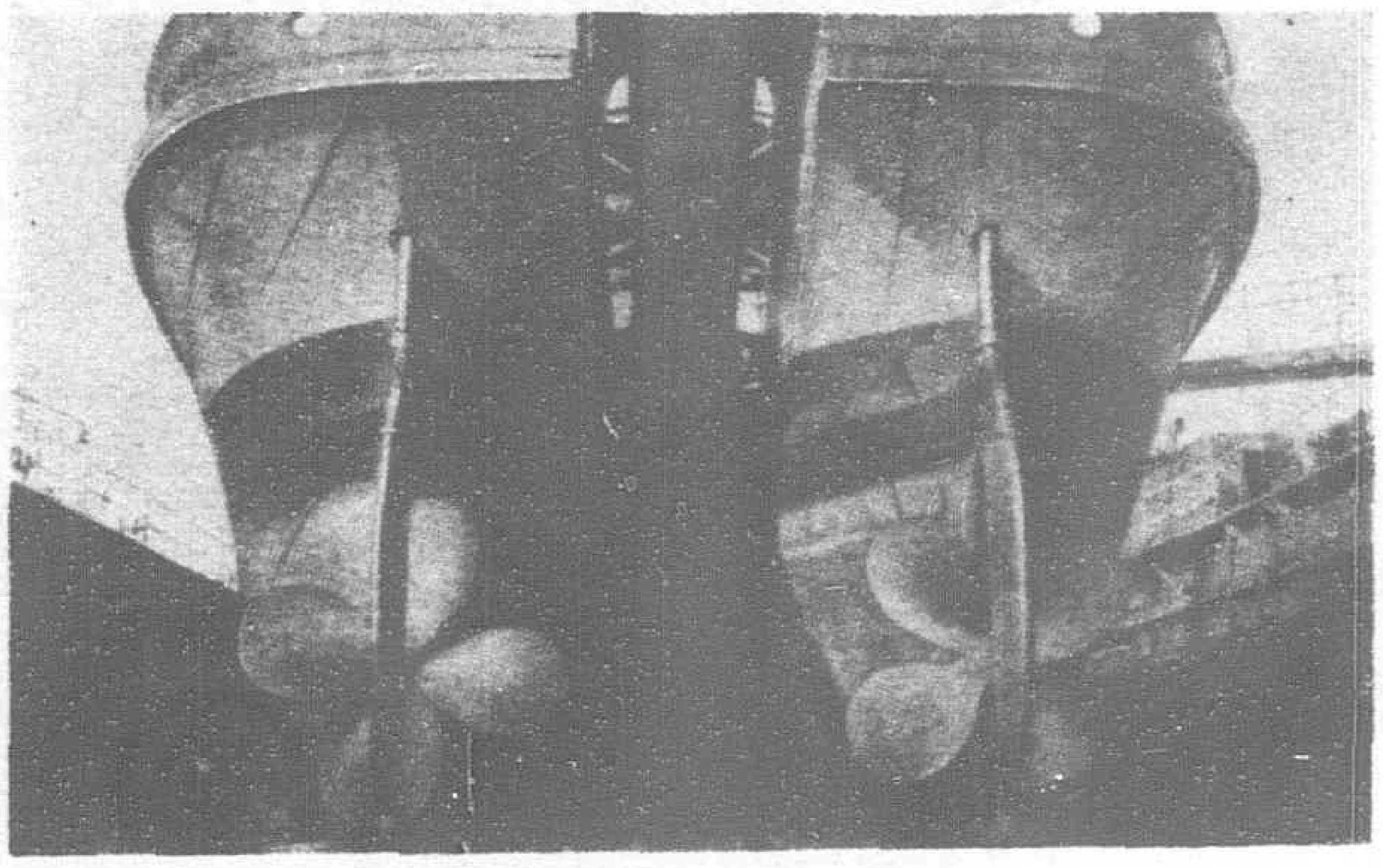


Fig. 11.—Stern View of Suction Dredge "Dredge Manila" Each of the two stern halves has its own rudder and propeller post

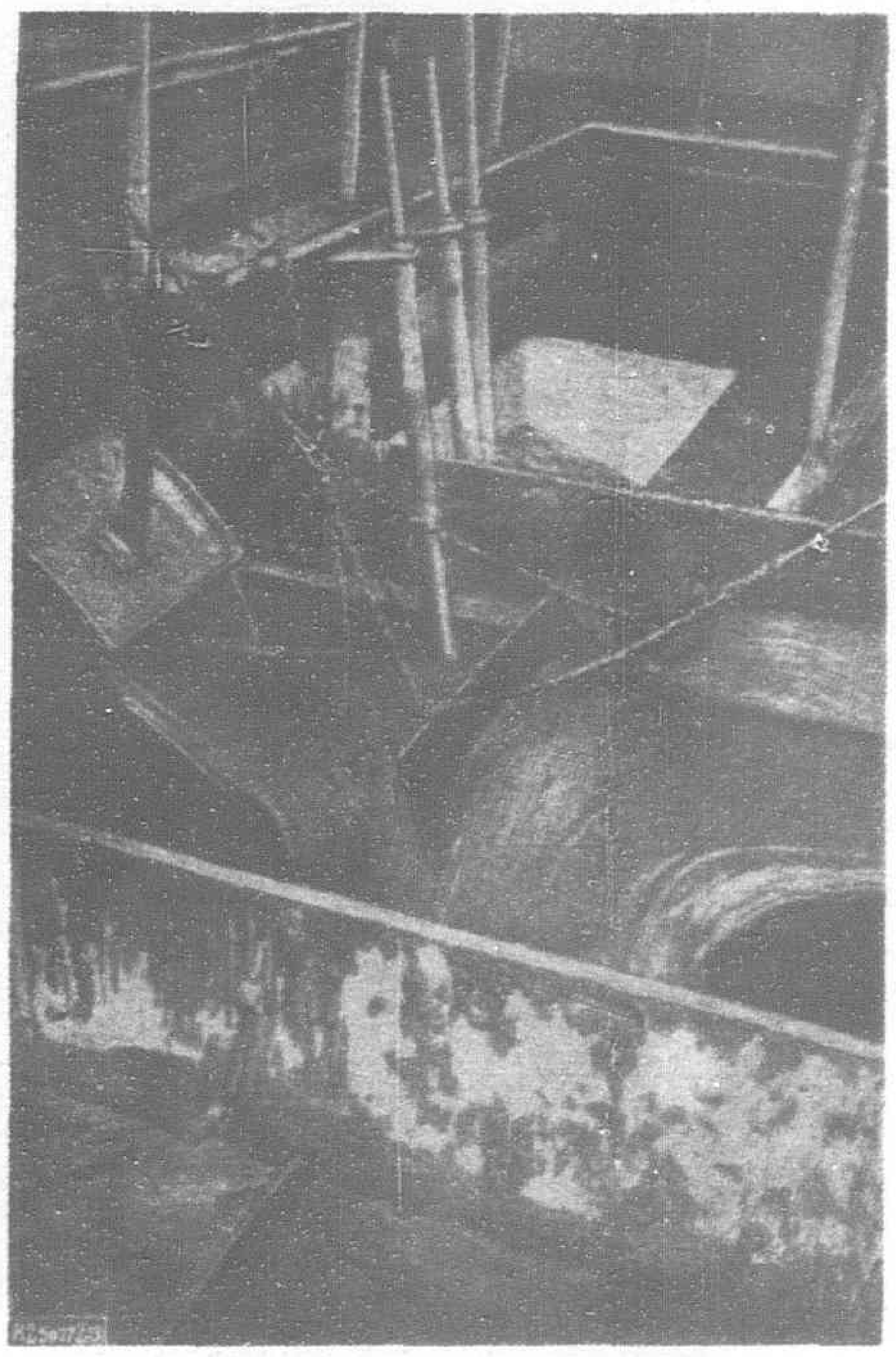


Fig. 13.—Dredgings Running from Pressure Line into Hold

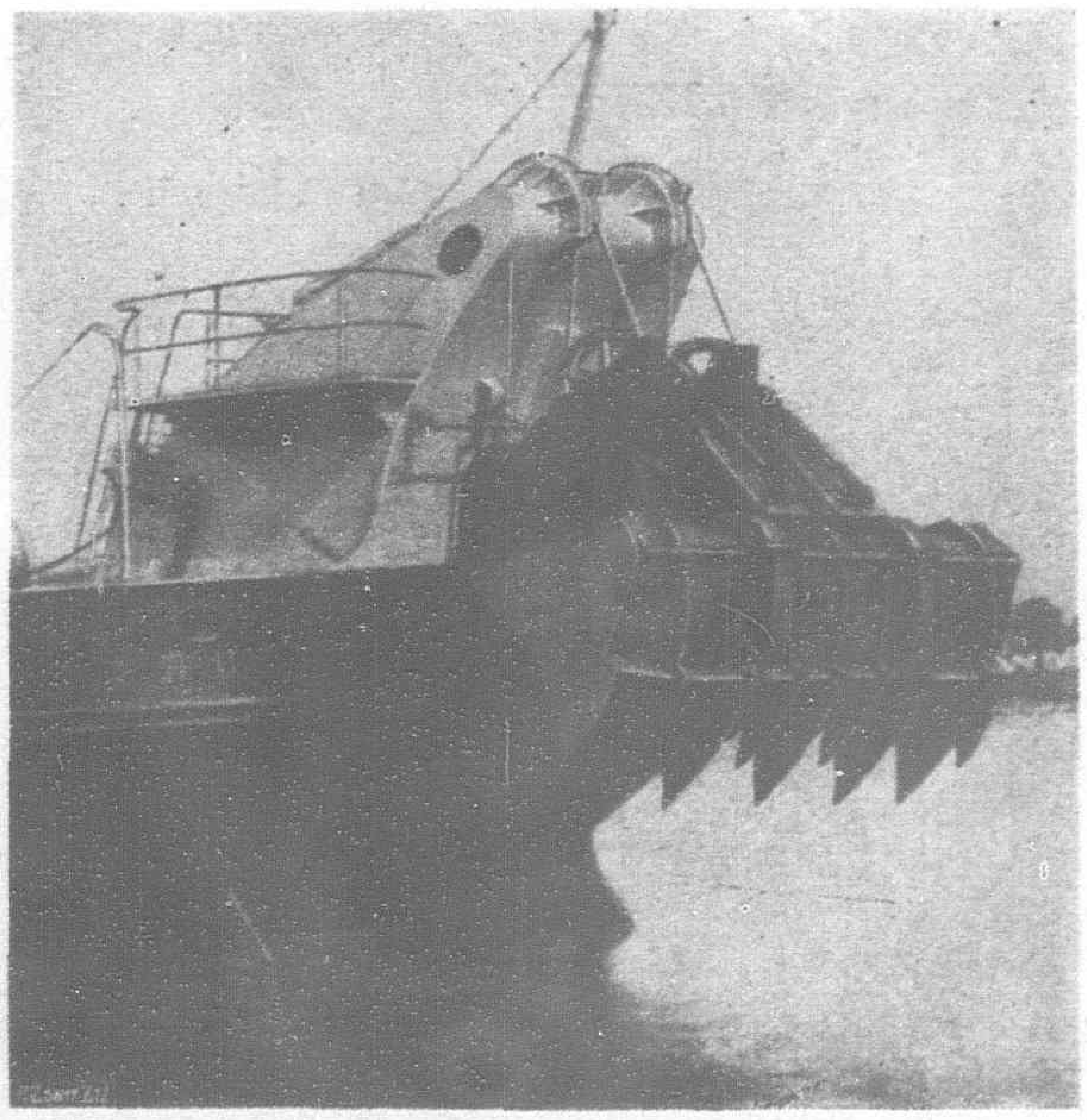


Fig. 12.—The Drag Head of the Dredge, into which the Suction Pipe Ends

The Drag Dredge "Dredge Manila"

This dredge was delivered to the American Government for the Philippine Islands in 1930. Its principal data appear below:

Length between perpendiculars, 57.905 m. (190 ft.); Beam, 10.82 m. (35.5 ft.); Height amidship, 4.7 m. (15.4 ft.); Draught, unloaded, at bow 1.3 m. (4.3 ft.); Draught, unloaded, at stern, 3.4 m. (11.2 ft.); Mean Draught, completely equipped, and with 1,000 tons of dredgings and 73 tons of coal and water, 4.0 m. (13.2 ft.); Capacity of hold, at 1.65 specific gravity of dredged material, 600 cu.m. (21,000 cu. ft.); Mean running speed, loaded, 10 knots; Greatest dredging depth 15 m. (49 ft.); Number of officers and men, 12.

The dredge, which is shown in the accompanying illustration, was built as a sea-going vessel according to the specifications of the Germanische Lloyd for Class "$+100\frac{A}{4}$K Dredge." The general features of the dredging installation are shown in Figs. 7 to 10.

The hold of the vessel is divided by five transverse and several longitudinal bulkheads into a total of nine watertight compartments. At both sides of the hold are provided overflows communicating below deck with discharge pipes open to the sea. By this arrangement, overflow water is kept away from the deck. Each of the two stern sections has its own propeller and rudder post, as may be seen from Fig. 11. The two rudders are interconnected and driven by one steam engine.

In view of the fact that navigation and dredging must go hand in hand in a sea-going dredging, all navigating-control elements, as well as the control levers of some important parts of the dredging equipment, are united on the bridge. The steam anchor winch on the forecastle has a capacity of 15 tons, which is sufficient to move the ship when dredging is done at anchor, or in other words without the use of the ship's screws. Two steam winches are, in addition, provided on the quarter-deck for general purposes.

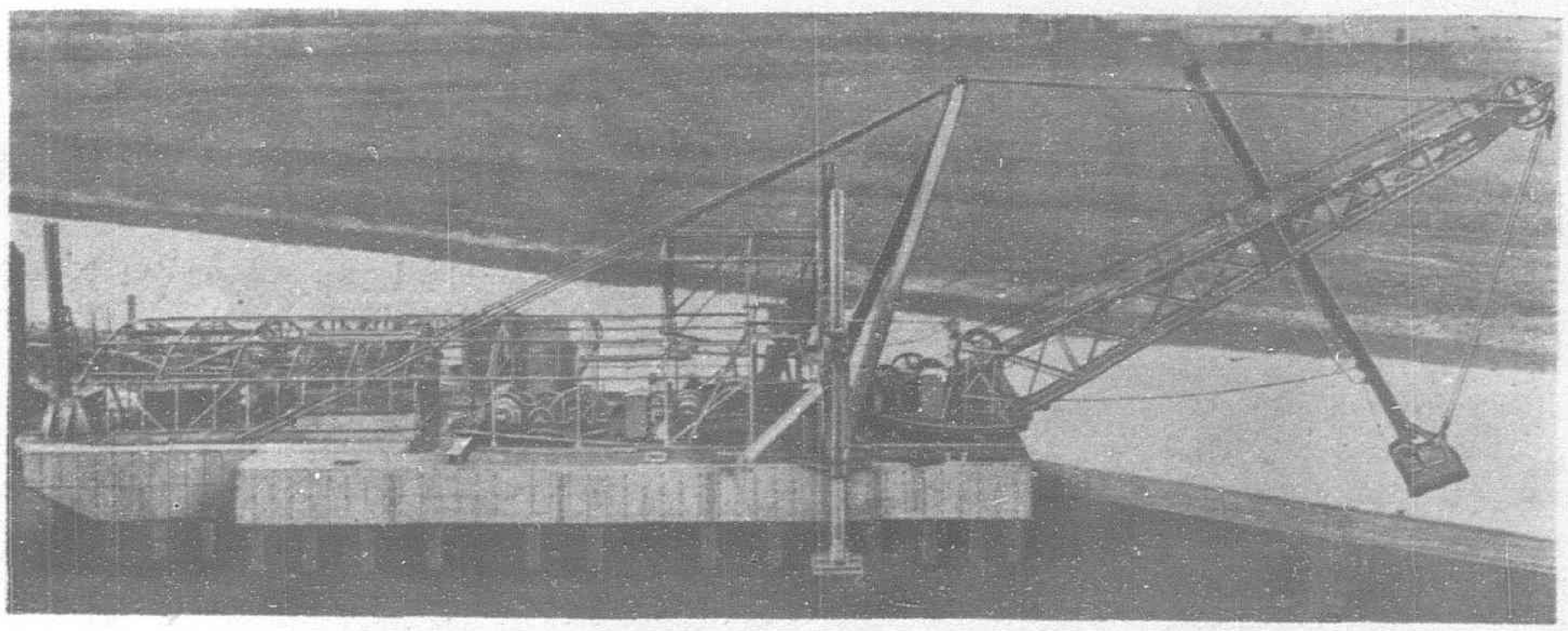
The engine plant of the dredge consists of four vertical double-expansion steam engines, developing, at a speed of from 180 to 190 r.p.m., a total of 1,000 indicated horse-power. The engines are arranged so as to enable them to be coupled in pairs for driving either the propeller or the dredge pump. When disconnected, the rear engine drives the propeller and the forward one the dredge pump. By these different possible combinations, the engine plant may be readily adapted to the prevailing requirements of the dredging service.

Steam at 10 atmos. (140 lb. per sq. in.) is supplied by two three-flue marine boilers with a total of 364 sq. m. (3,950 sq. ft.) heating area and 11 sq. m. (120 sq. ft.) grate area.

The two dredging pumps work independently of each other. They

(Continued on page 445).

Diesel-Electric Dipper Dredges



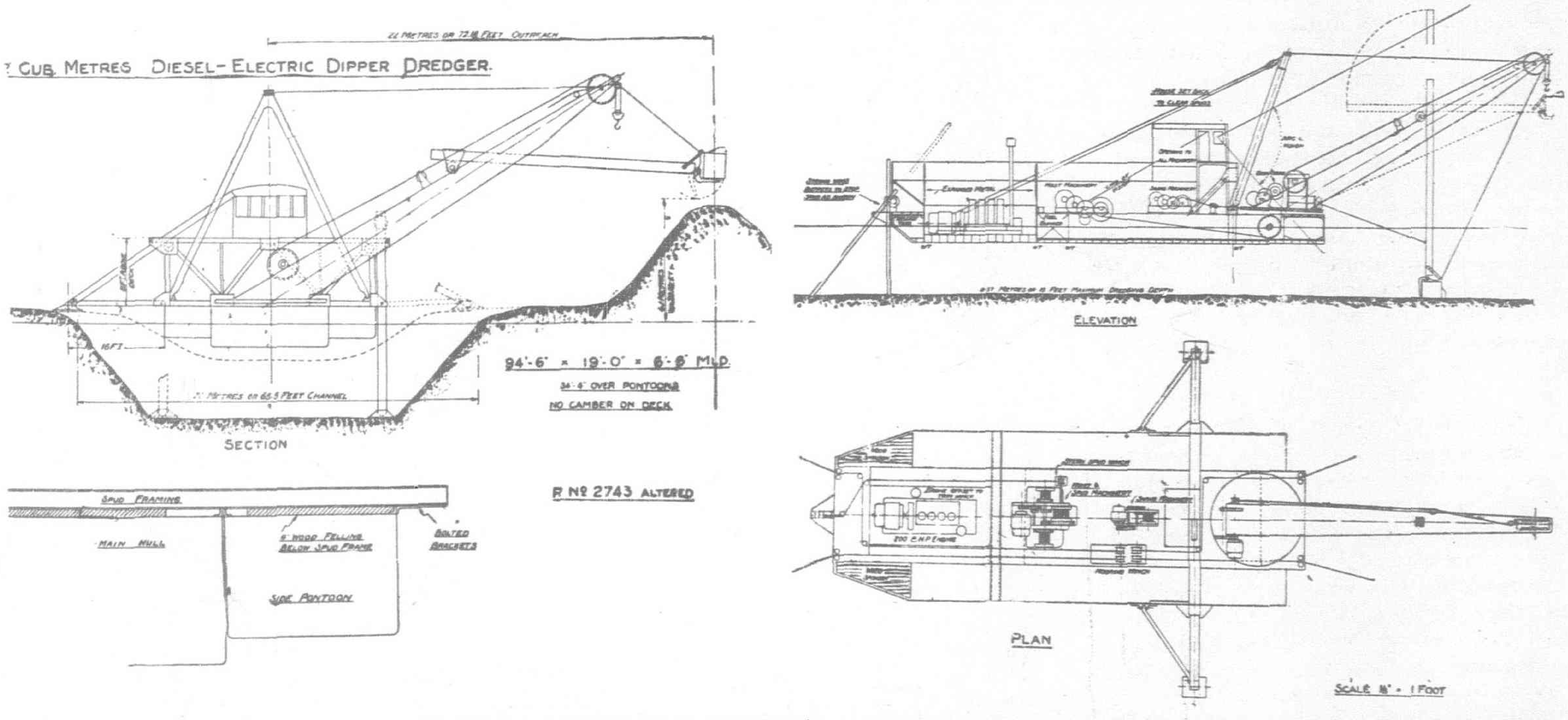
Diesel-Electric Dipper Dredge built for Royal Irrigation Department, Siam

DIESEL-Electric Dipper Dredges, as supplied by Messrs. Barrow, Brown & Co., Ltd., of Bangkok, Siam, from the Phoenix Works of Messrs. Fleming & Ferguson Limited of Paisley, Scotland, are in use in a number of places in the Far East.

A recent new enterprise is a large Diesel-Electric Dipper Dredge being supplied by Messrs. Barrow, Brown & Co. to the Royal Irrigation Department at Bangkok, Siam. This big dredge which is shown in the accompanying illustration is now in course of erection. It's details include "capacity of bucket 2½ yards; outreach 72 feet; clear height of dump 20 feet—output 150 yards per hour. Dredges at work in the Far East, commonly are used for digging and deepening irrigation canals. The dredge shown in the illustration can dig a canal from four to 15 feet deep. The spuds are arranged for use either vertically or as bank spuds. The vessel is stable with the boom swung at right angles to the hull, and with the loaded bucket fully extended, without reliance on the spud, which may occasionally yield in soft ground.

The use of the Diesel-Electric drive for dredges located in the remote districts is adopted generally principally to reduce fuel cost. The electric control also reduces the amount of manual labor and increases ease of operations, especially in a hot climate tending to increase output. The electric control is worked on the "Ward-Leonard" system which permits the bucket to stall with impunity when handling hard substances. Dredges of the kind shown carry repair facilities and compressed air tools. The hull is formed with three independent pontoons, the essential machinery being carried on the center pontoon. With the side pontoons detached, the dredge can pass through a lock 19 ft. 6 in. wide and can be stripped down to pass under bridges 10 ft. above water line. Messrs. Barrow, Brown & Co, have lately supplied also several steam dipper dredges, burning wood fuel and oil fuel up to six yards capacity with 88 ft. outreach.

At their Phoenix Works at Paisley, Scotland, Messrs. Fleming & Ferguson build all kinds of floating dredge plants, reclamation pumping plants, and floating cranes. The company has been operating for more than a half century with the mechanical side of dredging in all parts of the world, and lately has been supplying a number of suction dredges for reclamation work and Diesel-engined suction dredges for canal work. The nature of the soil, depth of dredging, distance of delivery, available source of power, labor and transport facilities and tidal conditions offer a vast number of variations affecting the design of dredge plans.


22 METRES OR 72.18 FEET OUTREACH
CUB. METRES DIESEL-ELECTRIC DIPPER DREDGER.
16 FT.
METRES OR 65.5 FEET CHANNEL
94'-6" × 19'-0" × 6'-6" MLD.
34'-6" OVER PONTOONS
NO CAMBER ON DECK
SECTION
SPUD FRAMING
MAIN HULL
WOOD FELLING BELOW SPUD FRAME
BOLTED BRACKETS
SIDE PONTOON
R Nº 2743 ALTERED
HOUSE SET BACK TO CLEAR SPUDS
EXPANDED METAL
HOIST MACHINERY
SWING MACHINERY
METRES OR 15 FEET MAXIMUM DREDGING DEPTH
ELEVATION
200 E.H.P. ENGINE
PLAN
SCALE ⅛" = 1 FOOT

Suction Dredge "Manila"

(Continued from page 444).

have impellers of a diameter of 1,400 mm. (4.25 ft.) and together are able to move into the hold a total of from 600 to 800 cu. m. (21,000 to 28,000 cu. ft.) per hour of pure loose sand, or 1,400 to 1,600 cu. m. (50,000 to 57,000 cu. ft.) per hour of soft silt. Each pump has its own suction and discharge pipe line of 450 mm. (17.8 in.) diameter. The two suction pipes are united by a strong steel-plate construction into a rugged truss, which is pivotally suspended on a horizontal axis between the two stern halves and carries the drag head at the end, as shown in Fig. 12. The truss with the drag-head and suction pipe is raised and lowered by a winch located amidships on the quarter-deck. The time required for raising it from a depth of 15 m. (50 ft.) to the horizontal is 2½ minutes. The pressure pipes of the dredge pumps are joined by a cross-connection. They extend along the entire hold, and unload the dredgings through adjustable discharge doors into the several hold sections, as shown in Fig. 13.

Dumping is effected either through twelve trap-doors, or by a suction installation operated by the two dredging pumps. In pumping out the different hold sections, surplus water is introduced from outboard, and loosening of the spoil aided by the introduction of water under pressure. This arrangement, which also is covered by patent, has the advantage of preventing interference with the surplus-water feed from falling dredgings. The required pressure water at 5 atmos. (70 lb. per sq. in.) is supplied by a special duplex pump of 3,500 l. (770 Imp. gal.) per min. capacity. The same pump also supplies what water under pressure is required by the drag during work, and in addition serves as a ballast pump.

Hupeh's Long-Distance Telephones

HUPEH in the heart of Central China now boasts long-distance telephone lines of a length of 8,638 li. This system has only recently been installed at a cost of G$ 279,297. A net-work of telephone communications now radiates through the whole province with its 69 hsiens and its 16 market centers. The system involves seven main lines and 41 branch lines, and the head office is located at Hankow, on the Yangtze. Branch offices have been established at Wuchang, Ichang, Shasi and Fanchen. In the small hsiens cut-in stations are installed, and in a number of the market centers only single telephones are to be found. The entire province has one 50-exchange switchboard, fourteen 10-exchange switchboards, ten five-exchange switchboards, 37 cut-in stations and 90 centers with single telephones.

The seven main lines have a total length of 4,930 li. The line which links Hankow and Ichang is the longest—780 li. The 41 branch lines have a total length of 3,708 li, making a total of 8,638 li of long distance lines.

The porcelain insulators, wires, switchboards and telephones used in the system were purchased from a number of foreign companies, after extensive tests by experts. The ringing-through test and the talking test were employed with the result that the products of Messrs. Ericsson & Company were selected for use over the entire system. Wires and switchboards were bought from Messrs. Siemens (China), Co., Messrs. China Electric Company and others. The length of the different lines, equipment and cost of the various details of the project are set forth in the following two tables :—

Table 1. Length of the Hupeh Long-distance Telephone System

A. Main Lines

(1) North Hupeh Main Line from Hankow to Fanchen

1.	Hsia-kow	20 *li*
2.	Hwangpei	70 ,,
3.	Siaokan	100 ,,
4.	Yunmeng	65 *li*
5.	Anlu	45 ,,
6.	Suihsien	170 ,,
7.	Saoyang	130 ,,
8.	Siangyang	140 ,,
	Total	740 *li*

(2) Fanchen to Yunsi

9.	Kucheng	50 *li*
10.	Kwanghua	60 ,,
11.	Kunhsien	200 ,,
12.	Yunyang	140 ,,
13.	Yunsi	50 ,,
	Total	500 *li*

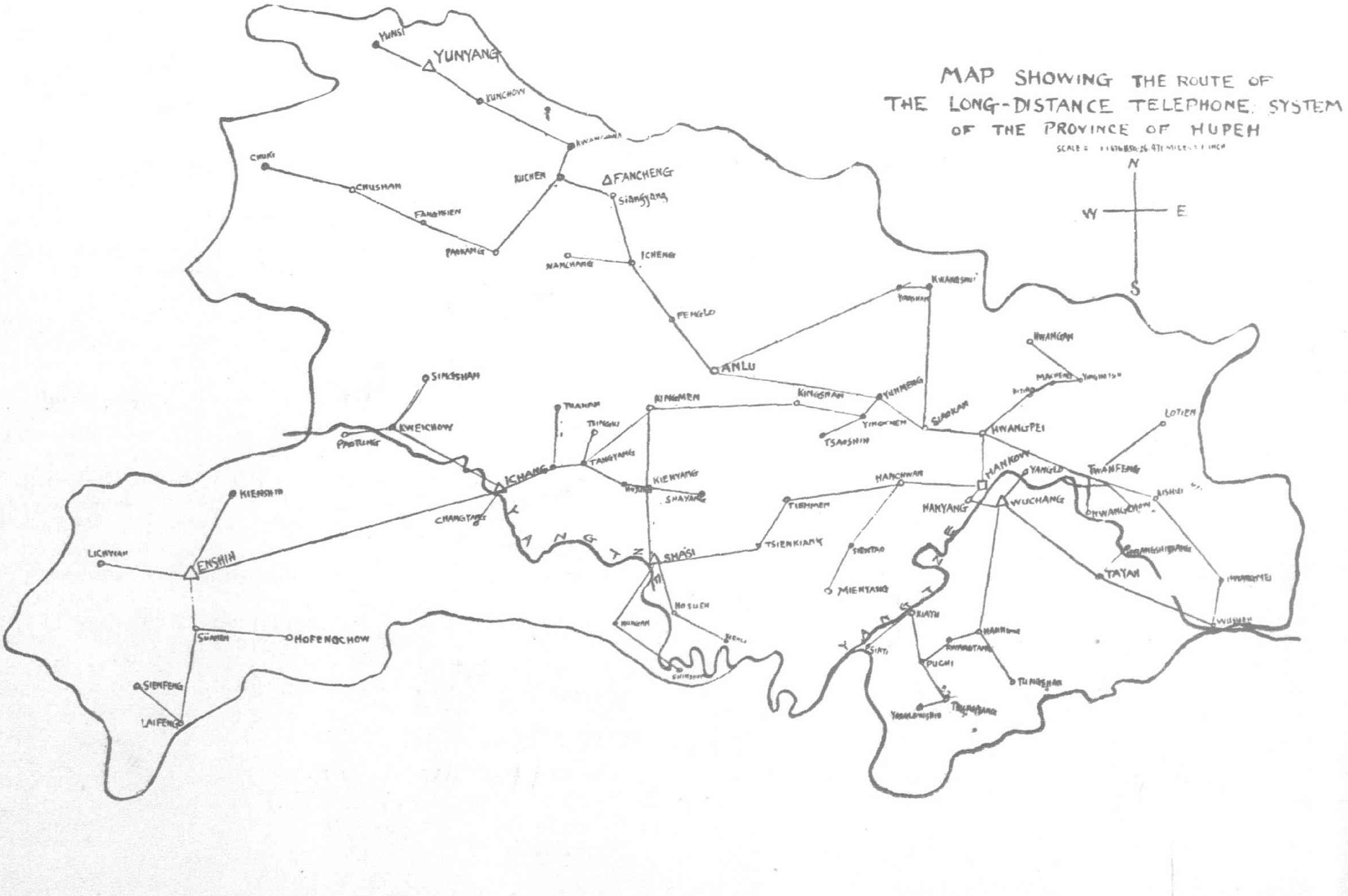
(3) Fanchen to Chuki

14.	Kucheng	230 *li*
15.	Paokang	120 ,,
16.	Fanghsien	160 ,,
17.	Chushan	140 ,,
18.	Chuki	60 ,,
	Total	710 *li*

Grand total for the North Hupeh line .. 1,950 *li*

II. Hankow-Shasi line

1.	Hsiakow	80 *li*
2.	Hanchwan	90 ,,
3.	Mienyang	110 ,,
4.	Tienmen	17 ,,
5.	Tsienkiang	106 ,,
6.	Kianglin	70 ,,
	Total for the Hankow-Shasi line	473 *li*



III. Hankow-Ichang line

1.	Hsiakow	80 *li*
2.	Siaokan	25 ,,
3.	Yunmeng	20 ,,
4.	Yingcheng	86 ,,
5.	Kingshan	150 ,,
6.	Tsunghsiang	130 ,,
7.	Kingmeng	94 ,,
8.	Tangyang	135 ,,
9.	Ichang	80 ,,
	Total for the Hankow-Ichang line	780 *li*

IV. Wuchang-Yanglo line

1.	Wuchang	137 *li*
2.	Sienning	75 ,,
3.	Puchi	150 ,,
	Total for the Wuchang-Yanglo line	362 *li*

V. Siangyang-Shasi line

1.	Icheng	95 *li*
2.	Kingmeng	165 ,,
3.	Kiangning	185 ,,
4.	Shasi	15 ,,
	Total for the Siangyang-Shasi Line	460 *li*

VI. Ichang-Enshih Line

1.	Ichang to Enshih	470 *li*
	Total for the Ichang-Enshih line	470 *li*

VII. Hankow-Chinkiang Line

1.	Hwangpei	60 *li*
2.	Chihting	80 ,,
3.	Tuanfen	55 ,,
4.	Kishui	50 ,,
5.	Kwangtsi	80 ,,
6.	Hwangpei	60 ,,
7.	Chinkiang	50 ,,
	Total for the Hankow-Chinkiang line	435 *li*
	Grand total for the Main lines	4,930 *li*

B. Branch Lines

I.	North Hupeh Branch Line	180 *li*
II.	Hankow-Shasi Branch Line	565 ,,
III.	Hankow-Ichang Branch Line	180 ,,
IV.	Wuchang-Yanglo Branch Line	498 ,,
V.	Siangyang-Shayang Branch Line	200 ,,
VI.	Ichang-Sienfeng Branch Line	1,280 ,,
VII.	Hankow-Hwangan Branch Line	805 ,,
	Total for the branch lines	3,708 *li*

Table II. Equipment and Expenditure of the Hupeh Long-distance Telephone System

	Kinds of material	*Quantity*	*Value (American gold dollars)*
1.	Wires	840,000 lbs.	166,606.00
2.	,,	245,000 lbs.	49,588.00
3.	,,	1,560 ft.	4.20
4.	,,	5,000 ft.	107.50
5.	,,	2,000 ft.	34.00
6.	,,	40,000 lbs.	1,345.20
7.	Fifty-exchange switchboard.	1 piece	1,046.00
8.	Ten-exchange switchboard.	14 pieces	2,772.00
9.	Five-exchange switchboard.	10 ,,	1,390.00
10.	Cut-in-stations	37 ,,	358.90
11.	Telephones	80 ,,	1,996.20
12.	,,	2 ,,	53.00
13.	,,	2 ,,	49.00
14.	,,	5 ,,	105.50
15.	,,	3 ,,	88.50
16.	Procelain insulators	160,000 ,,	37,280.00
17.	Procelain insulator nails	25,750 pairs	3,199.43
18.	Telephone cables	20,000 ft.	3,300.00
19.	Brass tubes	140 lbs.	32.62
20.	Dry battery	250 pieces	87.50
21.	Others		813.50
	Total		G$.270,297.55

The New Excursion Motor Ship "Tennyo Maru"

(Continued from page 440).

The manoeuvering device is also of the builders' patented design, in which the engine operates automatically ahead or astern by turning a hand wheel clockwise or anti-clockwise, and the state of the engine performance and the variation of the output, etc., are indicated on a dial fitted near to the handle, so that the engine can easily be manoeuvered by either a skilled or unskilled engineer.

The engine can be started by a starting air pressure of 42 kgs. to 10 kgs. The capacity of the main air reservoirs being 1,800 litres, it is possible to carry on repeated manoeuvering of over 37 times.

Auxiliary machinery installed in the engine room is as follows:—

Two 15 kw. Diesel generators, one of them being coupled to a manoeuvering air compressor.
One hand driven emergency compressor.
One general service pump.
One combined fuel oil transfer and spare lubricating oil pump.
One fresh water pump.
One lubricating oil purifier.
Two manoeuvering air reservoirs.
Two auxiliary air reservoirs.
One lubricating oil heater.
One main engine silencer (in funnel).
Two auxiliary engine silencers.

All the auxiliary machinery is electric driven except otherwise stated.

Trial Results

The shop tests were carefully carried out in January, 1931, in the Mitsubishi Kobe Works and the results are shewn in the table and curves attached.

Various sea trials were held on February 17 and 19, 1931, off the mile posts near Kobe. The results of the progressive trial and official full power trials are given below :—

	Progressive Trial.				*Official Trial.*
Dates	17th February, 1931.				19th February, 1931.
Place	off Kobe.				off Kobe.
Weather	fine.				fine.
Draught, fore	5′-4″				5′-5″
aft	7′-5¾″				7′-5¼″
mean	6′-4⅞″				6′-5⅛″
Displacement	362.67 tons.				365.13 tons.
Load	4/4	3/4	1/2	1/4	overload
Speed in knots	14.228	13.310	11.983	9.816	14.810
R. P. M.	250.5	230.0	197.0	161.0	266.0
Mean effective pressure kg/cm^2	6.71	5.37	4.49	3.29	7.33
I. H. P.	842	621	444	266	977
B. H. P.	701	481	325	165	831

The results are plotted to curves as shewn in the attached sheet.

Dial Telephone Exchanges of Shanghai Power Company

Three Strowger Automatic Dial Exchanges with Inter-Office Trunking Facilities

By L. BEAUMONT, Relay Engineer, Shanghai Power Company

THE Shanghai Power Company supplies the whole of the electrical energy for the International Settlement of Shanghai and also for an extensive area around the settlement. The territory served has an area of approximately 20 square miles with an estimated population of 1,583,000. This district is remarkable for the intensity of its industrial loading, the resultant electrical demand probably being unequalled by any other area throughout the world. Supply is given to some 270 substations ranging from 125 kva. to 40,000 kva. capacity. The company's network consists of some 201 miles of transmission lines and 715 miles of distribution system.

The Riverside Power Station with an installed generating capacity of 161,000 kw. is situated at the eastern extremity of the settlement, the distances from this point to the furthest substation equipped with an automatic telephone being about 14 miles. It will be realized that for operating purposes alone, the need for a reliable and rapid telephone service is of first importance. Some 60 of the more important substations, together with the various offices and depôts are equipped with automatic telephones, bringing the total number of telephones in commission to 236.

The automatic telephone equipment consists of three 200 line Strowger Dial exchanges with inter-office trunking facilities, situated at the Riverside Power Station, the central offices and the Fearon Road substation. Figure 1 gives the geographical layout of the three exchanges and a number of the more important substations. The distance between the riverside and Fearon Road exchanges is about 5½ miles and between the Fearon Road and central office about 1½ miles.

The riverside and Fearon exchanges are connected by three underground telephone cables, one 50 pair, one 16 pair and one eight pair. The cables are of the usual dry core type, the conductors weighing 10 lb. per mile. The central office and Fearon exchanges are connected by two 16 pair cables and one eight pair. Connection between the riverside and central office exchanges is made on the M.D.F. at the Fearon Road exchange, as all the riverside and central office cables terminate in that exchange.

Referring to Fig. 2 which shows the inter-office trunking scheme it will be seen that there are five outgoing and four incoming trunks at the central office exchange to and from the riverside and Fearon Road exchanges, four outgoing and five incoming trunks to and from the riverside and central office exchanges at Fearon and five outgoing trunks to Fearon, four to the central office, with four and five incoming trunks respectively at the riverside exchange. The total number of route miles of telephone cable in commission is about 70, the conductor mileage being 2,000. The central office and riverside exchanges were installed in 1921, and the Fearon Road exchange, the following year.

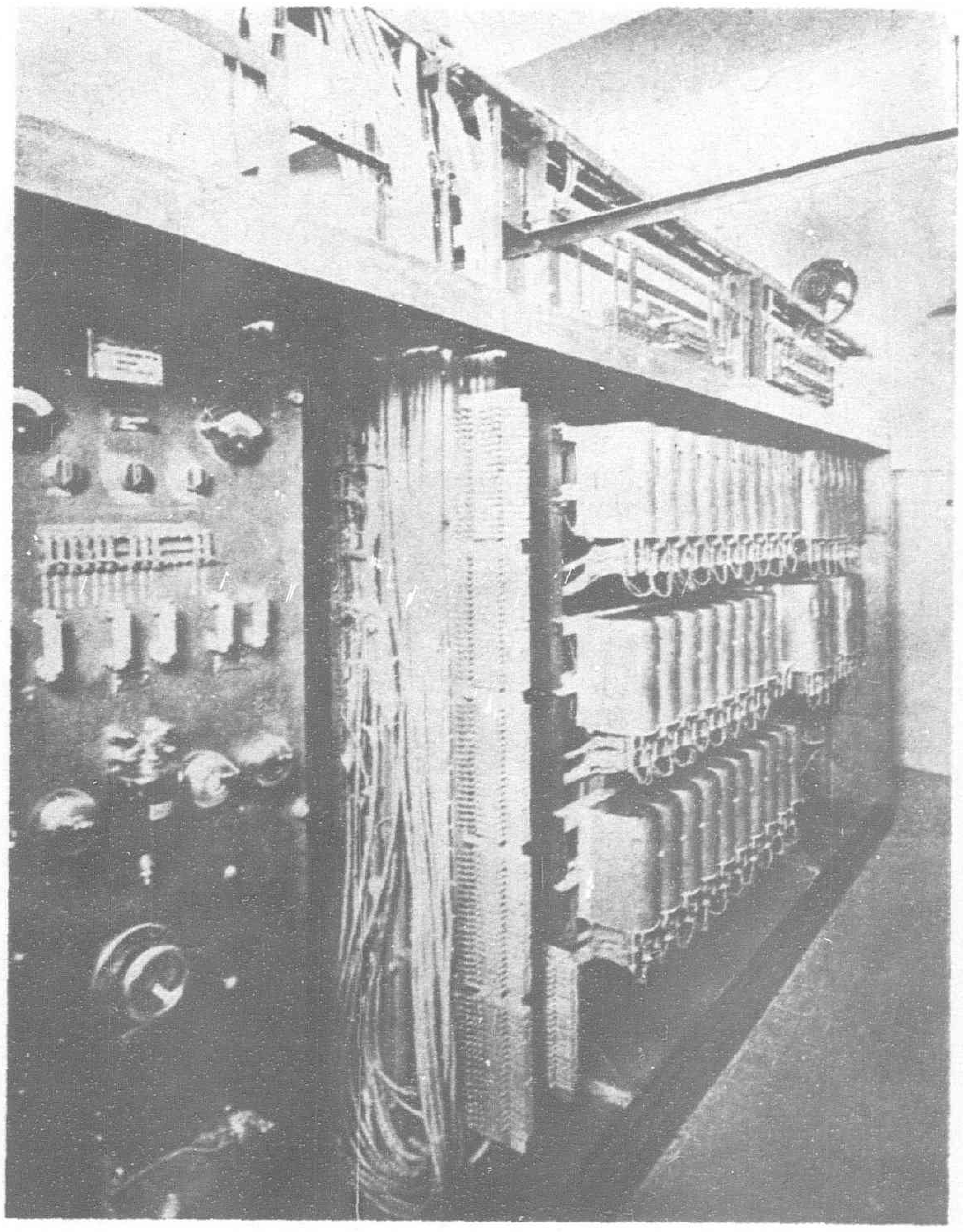


Fig. 3.—Strowger Dial Equipment at the Fearon Road Exchange, Showing Power Board, M. D. F., Selectors and Connectors

The Fearon and riverside exchanges are at present equipped for 100 lines each, having 100 and 69 working lines respectively, whilst the central office is equipped for 75 lines, having 61 in commission to date.

A new lineswitch upright wired for 100 lineswitches, master switch and eight extra connectors, together with six extra first selectors was ordered from The Automatic Electric Company, Ltd.,

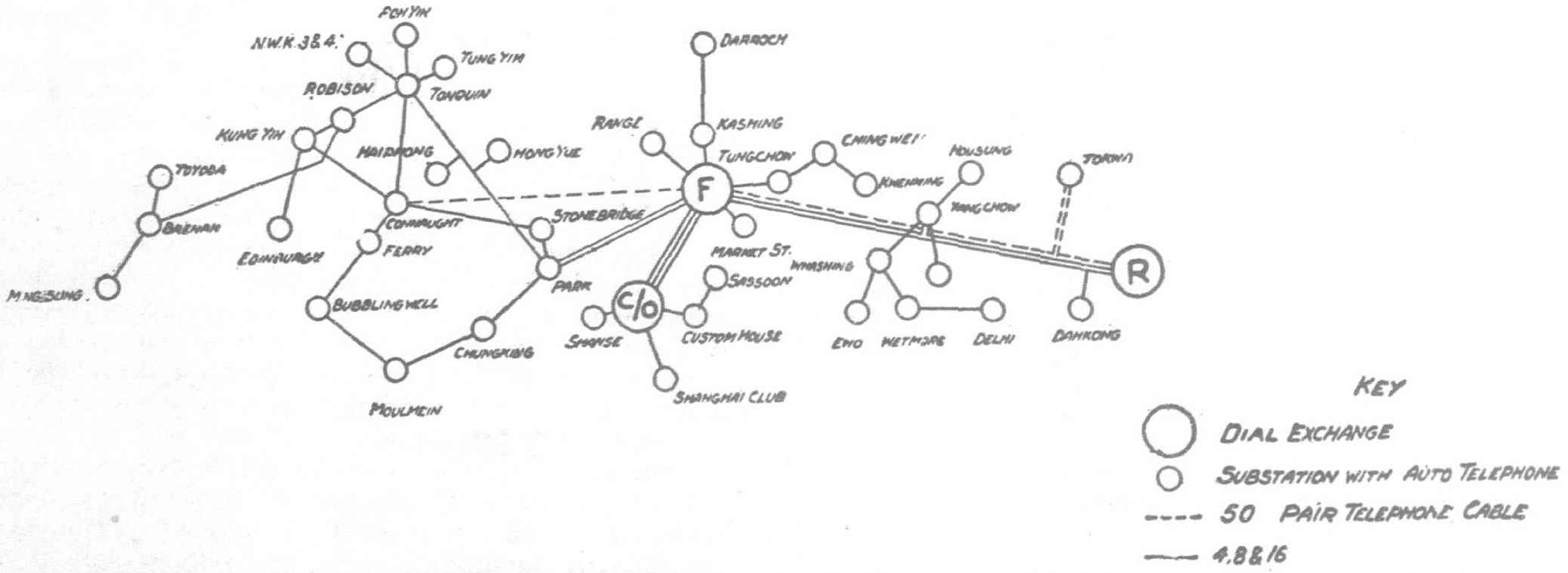


Fig. 1.—Schemastic Diagram Showing Geographical Location of Stowger Dial Exchanges and More Important Substations Equipped with Dial Telephones

of Chicago recently and when installed will bring the capacity of the Fearon Road exchange up to 200 lines.

The equipment in each exchange is identical, each having ten first selectors, eight local second selectors, eight to ten incoming second selectors, a similar number of outgoing repeaters, and ten connectors (eight regular and two special). The lineswitches are the plunger type having one master switch per hundred lineswitches.

Only three levels of the first selectors are at present in use ; namely levels 2, 3 and 4. Levels 2 (regular connectors) 5 (code call machine) and 9 (special connectors) are in use at present on the local second and incoming second selector banks, but levels 3 (regular connectors) and 8 (special) will be wired to the new connectors at the Fearon Road exchange. When the original 59 A.H. storage batteries were due for renewal, they were replaced by 30 A.H. batteries of the nickel-iron type, and these have given every satisfaction.

The circuit-breaker alarm equipment has proved its utility on numerous occasions, and its ability to indicate the substation in which a circuit-breaker has opened, say, due to a fault, has proved of great value in localizing trouble on the closely inter-connected distribution system. The tripping of the oil circuit breaker closes an auxiliary switch which in turn energizes the alarm relay. This operates and places a short across the telephone pair of the affected substation, giving a visual and audible signal to the attendants on duty at the Fearon Road substation. The hold trunk bank contacts of the lineswitch are wired to the alarm lamp board and the coil of relay " B " on the first selectors.

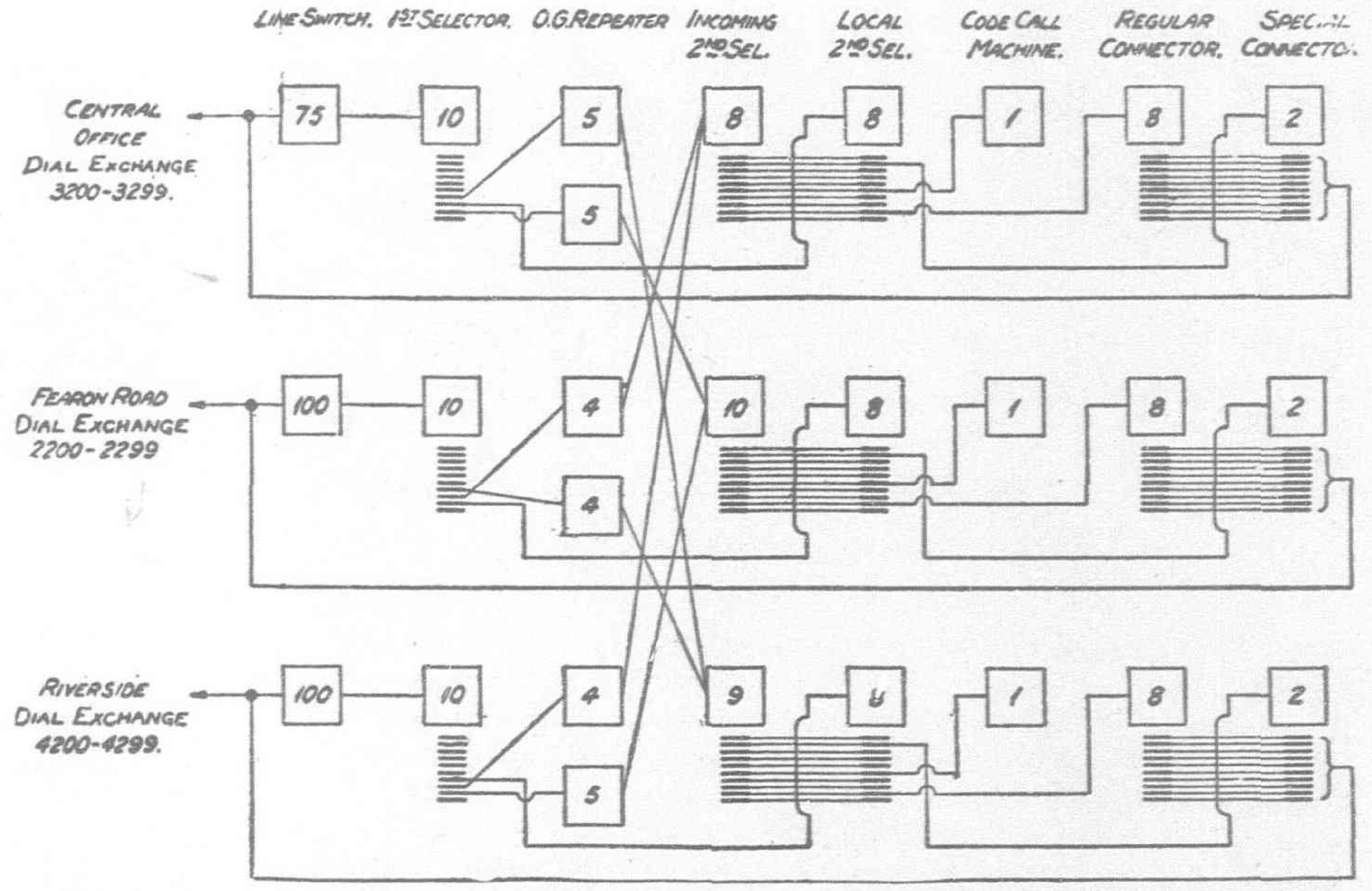


Fig. 2.—Trunking Scheme for Shanghai Power Company Dial Exchanges. Figures Indicate Number of Various Units Installed

When the telephone lines are lopped, due say to the opening of a circuit breaker, the lineswitch plunges in and engages a trunk to the first selector. The line and release relays of the selector operate, and earth is fed from break contacts of relay " D ," *via* make contacts of relay " A " to coil of relay " B " and thence *via* jack springs, lamp signal trunk tag block, lineswitch bank contacts, lamp signal line tag block to line terminal in alarm lamp cabinet, through signal lamp, 3w. relay to negative battery. The lamp glows in series with the 3w. relay which operates and closes the dash-pot relay circuit. The dash-pot relay when operated to its full stroke closes the alarm bell circuit giving the audible alarm.

In the case of a telephone call being made however, the lamp will only glow during the vertical and rotary motion of the first selector, after which relay " D " operates and removes the earth fed to the lamps. In this case, the dash-pot relay does not operate to the full stroke and the alarm bell does not ring.

The circuit breaker alarm relay is at present installed in 50 of the most important substations and now forms part of the standard substation equipment. The code call machine has also proved its efficacy in locating the person required, and sounding the general alarm in cases of emergency. There are three installations, one in each exchange and the use of 22 code numbers permits of great flexibility.

In conclusion it may be said that the maintenance of the automatic equipment is carried out by the company's staff, and all extensions since the original installation have been carried out by them. The automatic telephone system therefore plays a very important part in the operation of this large power supply undertaking, where a reliable and rapid means of intercommunication between the power station and control room and the various offices, substations and depôts throughout the system is a vital necessity.

World's Largest Precious Metal Refinery Opened in London

The largest nickel and by-products refinery in the world has just been opened at Acton, London. This refinery, belonging to the Mond Nickel Company, deals solely with the by-products of nickel known as the platinum metals. There are, five or six metals more valuable than gold handled here, including ruthenium, platinum, paladium, rhodium, iridium and osmium.

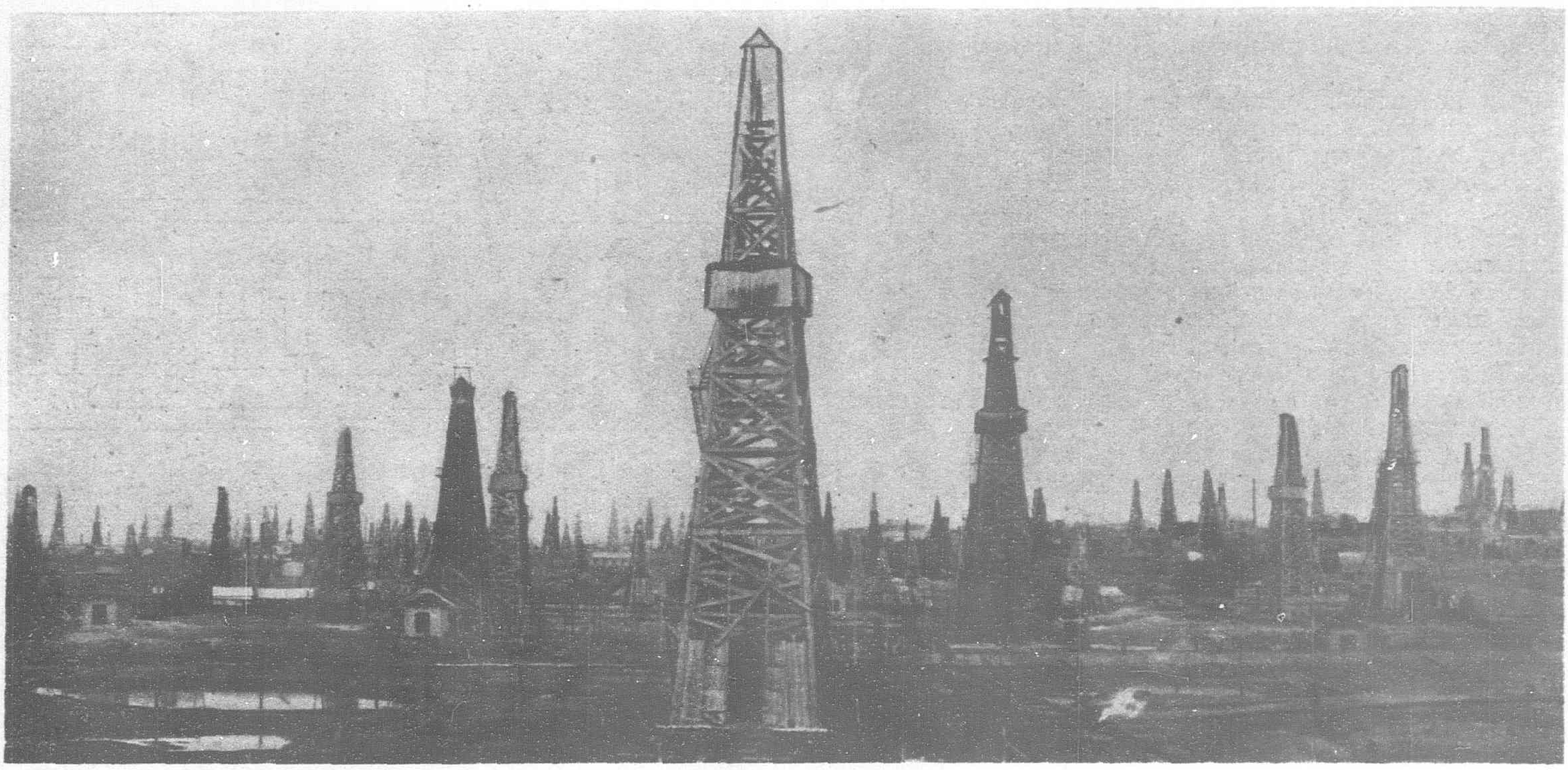
Last year the old Acton refinery treated 71,260 ounces of these precious metals, but the new refinery will have a capacity to deal with 300,000 ounces per annum. The total world-production of platinum is only 400,000 ounces, and Canada's proportion of this will be increased by the new refinery output which deals only with Canadian nickel.

Experiments in connection with paladium and silver are said to have satisfactorily demonstrated the fact that silver treated with paladium becomes untarnishable. This discovery may be of considerable importance as it will remove one of the main drawbacks to the more universal use of silver articles. In this way it may help to solve the silver problem provided, of course, that the cost of silverware is not materially increased by the new process.

The total consumption of nickel last year was 88,000,000 lbs., of which Canada produced 75,250,000 lbs.

The old Acton refinery was built for recovering the platinum metals contained in the concentrates produced at Clydach in the carbonyl process of extracting nickel. Later crude platinum from South Africa was treated, and later still, on the fusion of the Mond Nickel Company and the International Nickel Company, the treatment of concentrates from the electrolytic nickel refinery at Port Colborne, Ontario, was undertaken.

The metallurgical equipment of the refinery is on a much smaller scale and is more diversified than that found in the average heavy metallurgical works. Its most interesting feature is that the methods employed in the assay, chemical and electrolytic laboratory are conducted on a production scale, and necessarily the need for avoiding losses has a much greater influence on the design and layout of the plant than is the case in a works where less valuable materials are treated. In the refining process the precious metals have to be separated, not only from each other but also from 15 accompanying base metals, and they are recovered with an average purity ranging from 99.7 to 99.97 per cent. The high intrinsic value of the materials treated makes it imperative to reduce working costs to a minimum, and to obtain the maximum yield as quickly and directly as possible. In practice not more than ½ per cent of the platinum metals in the concentrates is lost, while 2½ per cent is temporarily retained in furnace slags, which are returned to the nickel refinery for retreatment. The remaining 97 per cent is produced directly as refined metal.



General View of the Surakhany Oil Fields of the Azneft Trust, near Baku

Soviet Oil Production

Outline is given of Progress Achieved under the Five Year Plan

On April 1, the Soviet Government announced that the oil industry had fulfilled the Five-Year Plan which laid down the output of oil in 1932-33 (the last year) as 21.7 million tons. In the current year, however, the oil output will be 27.5 million tons, which means that the estimates for this industry have been fulfilled in two-and-a-half years instead of five years. This also means that the U.S.S.R. now takes second place amongst the world's oil producers.

Pre-war Russia produced 9.3 million tons of oil per year. During the war and the Russian revolution the output was only 42.7 per cent of the total production of oil in 1913. During 1931 the output will be three times more than it was before the war.

The production of oil in the U.S.S.R. is increasing yearly. This is to be seen particularly in the Grozny district where the output increased from 13.2 per cent in 1927-1928 to 17.6 per cent in 1928-1929 ; 25.9 per cent in 1929-30 ; and in 1931 is expected to increase by 55.56 per cent as compared with the output for 1929-30. The same applies to the Baku district, where the increase of output was as follows : In 1927-1928 11.2 per cent ; in 1928-1929 13.6 per cent ; in 1929-1930 17.2 per cent ; and there will be a 50 per cent increase over last year's output.

Azneft (Azerbaijan Oil Trust) owes its great success not only to the enthusiasm of its workers, but to the system of rationalization which has been carried on in this industry—at a time, moreover, when other branches of industry were only beginning to be reconstructed.

Up to 1924-1925 boring was carried out in a most primitive manner owing to the fact that practically no modern machinery had been introduced in the Russian oilfields prior to the revolution. During recent years, however, enormous sums have been spent on up-to-date equipment and this has increased the speed of the work and considerably reduced production costs. The cost of boring in 1924-1925 was 335 roubles per metre, but after the introduction of rotary boring this figure was reduced to 206 roubles per metre, *i.e.,* 40 per cent cheaper.

Recently deep pumps have become widely used, and as a result of this the cost of production per well in a month dropped from 1.904 roubles in 1924-1925 to .935 roubles in 1928-1929, or in other words, showed a decrease by 50 per cent in the cost of production.

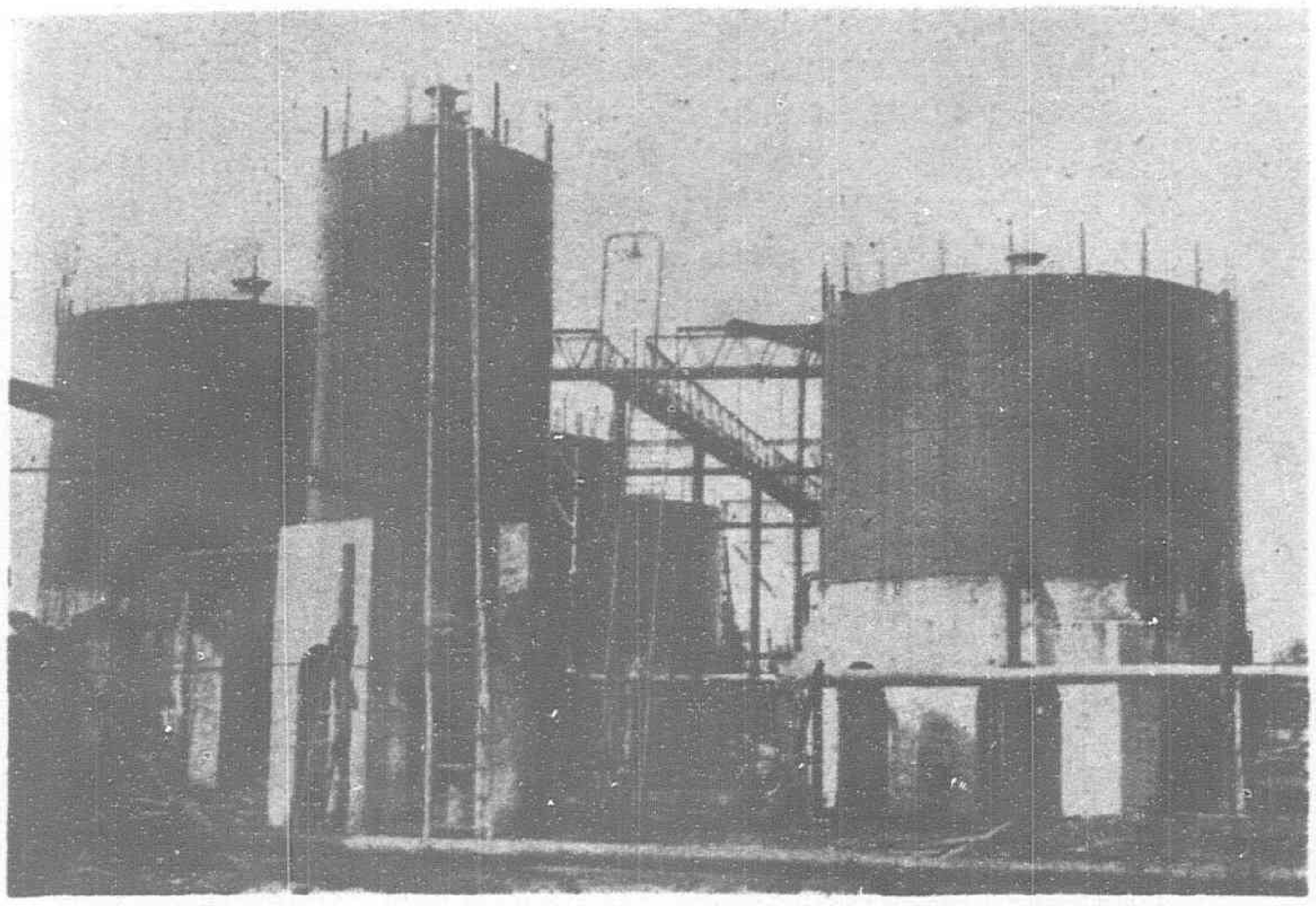
Rationalization in the oil production has led to the utilization of gas. In 1913 the output of gas in the Baku district was about 26,000 tons. In 1924-1925 it reached 84,000 tons ; in 1928-1929, 164,000 tons ; in 1929-1930, 186,000 tons ; and this year's production is estimated to be 500,000 tons.

Azneft is making extensive plans for the electrification of its plants and fields. Boring and pumping of oil is done exclusively by electricity. The total power of electric plants now reaches 100,000 kilowatts. Meanwhile, wind power is also used in the exploitation of wells by means of deep pumps. Cracking plant for the refining of oil has been installed for the first time in U.S.S.R. In view of the constantly growing demand for petrol to be used for automobiles and tractors working on State and collective farms, several other cracking plants will be erected in the near future.

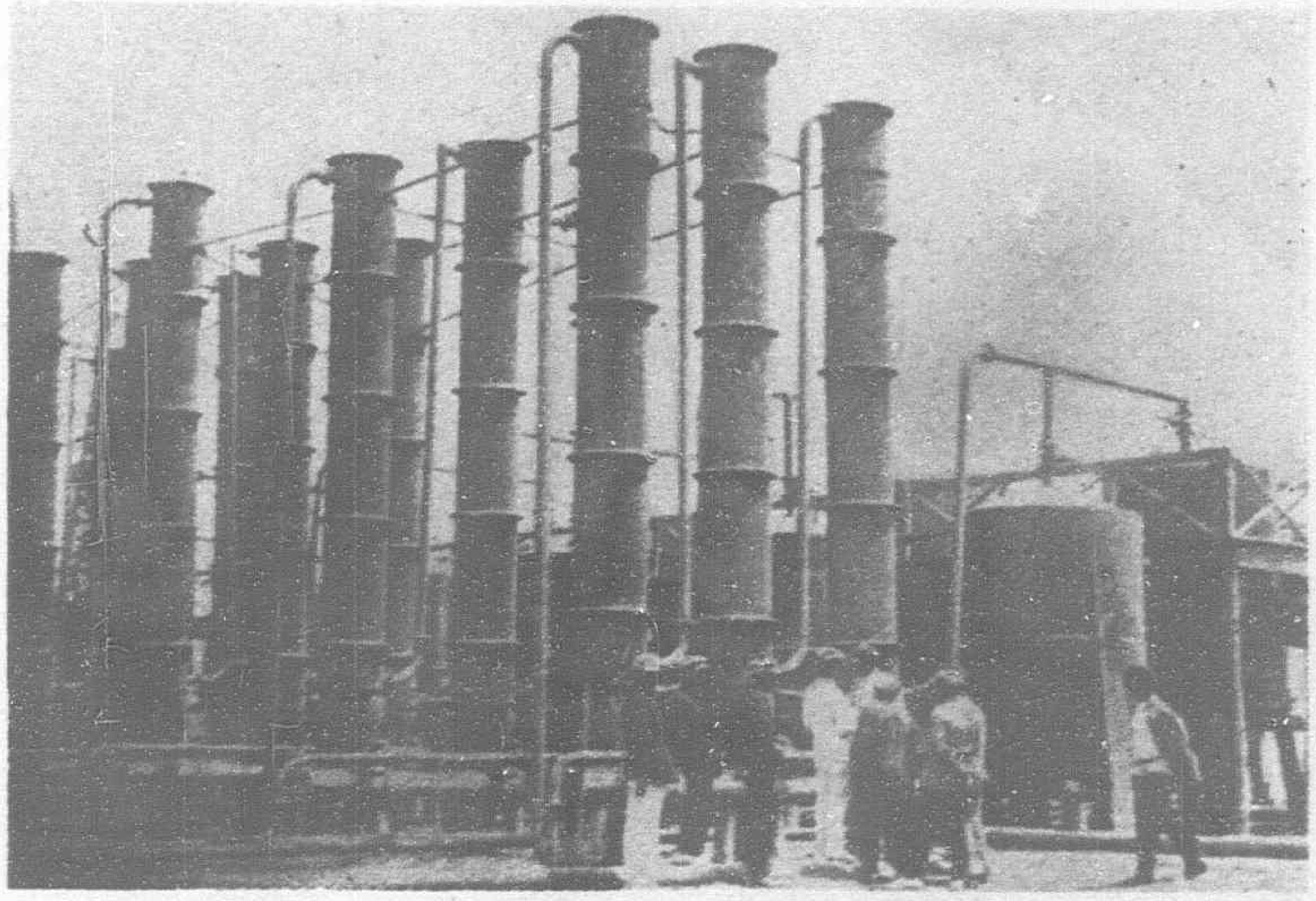
The ever-increasing production of oil in U.S.S.R. is creating a demand for various kinds of machinery for plants, while tankers for transportation of oil are required for the export trade.

With the growth of the oil industry, and the increasing productivity of labor, the general standard of living of the oil workers is also rapidly improving.

By the beginning of 1931 unemployment amongst miners in Azerbaijan had been completely wiped out. A seven-hour work day had been introduced in all the plants of Azneft. During the period of two-and-a-half years, workers' wages increased by 13.2 per cent. At present the average wage of the oil workers is 106 roubles 82 copecks per month. One should of course take into consideration the many privileges enjoyed by the workers, such as cheap housing, fares, health services, etc., etc. Many new buildings have been erected and during the period in question (two-and-a-half years) Azneft has spent 15.5 million roubles on erecting new houses. These homes are of an American type with all modern conveniences such as baths, electric lights, gas stoves, etc., etc. Several million roubles have also been spent in the erection of libraries, lecture halls, theaters, reading rooms, premises for all kinds of art as well as crêches and kindergartens for the use of workers and their children. In the Lenin district there is a new factory kitchen which supplies



Reservoirs of Refined Gasoline at the Azneft Refineries at Batum



Gasoline Works of the Azneft at the Surakhany Oil Fields in Azerbaidzhan

70,000 meals per day for the workers and their families. Seven more similar factory kitchens are now under construction. During this period also 3.5 million roubles have been expended on sanitary work and safety devices for the protection of the workers, and more than 11,000 workers were sent to various rest homes in the Caucasus and Crimea.

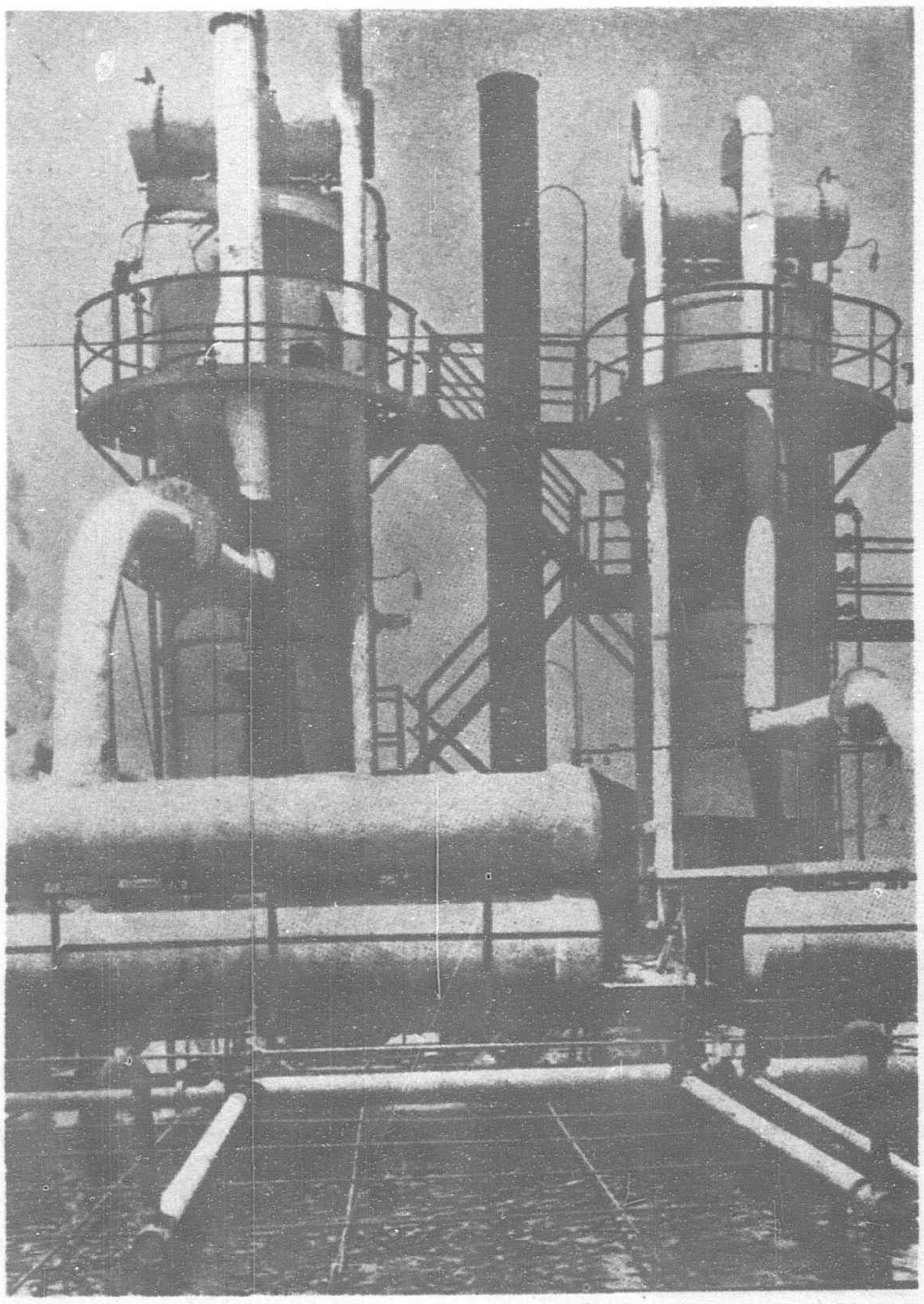
Oil production and refining in the U.S.S.R. has made rapid strides during the past few years. In order to increase the quantity of refined products an extensive program of construction of refining plants is being carried out, which in 1929-30 resulted in a 37 per cent increase in the amount of oil refined over 1928-29. The oil output for the three principal trusts in 1929-30 was 17,066,000 metric tons, of which 14,800,000 tons were refined, as compared with 13,602,000 tons in 1928-29, 10,800,000 tons of which were refined.

Construction and Reorganization

Among the important construction projects in the oil industry during 1929-30 were the completion in February of the Baku-Batum pipeline with a capacity of 1,640,000 metric tons, the completion of the Badger pipe still unit in Baku and of a vacuum distillation unit. Additions were made to several existing plants, including the "Red Star" electrical station in Baku, the capacity of which was increased to 20,000 kilowatts. A new power plant was opened in Batum and a cracking plant completed there in September. In the Grozny refineries there were installed two pipe stills of Soviet design in February and August, a Foster-Wheeler pipe still in August and a Winkler Koch cracking plant in September.

At the time the oil industry of the U.S.S.R. was nationalized, in May, 1920, it was at a very low ebb. Wasteful methods of exploitation in the pre-war period, followed by the destruction and disorganization wrought by the war and intervention, had resulted in the practical disruption of the industry. Oil refining was especially neglected. The main products were mazut (fuel oil) and kerosene, gasoline being produced only in insignificant quantites. The methods employed in refining were primitive. Pipe stills, cracking plants, plants for producing bright stocks were unknown. The civil war wrought havoc with the buildings and equipment of the few existing refining plants.

Production made slow gains during the first years after nationalization, but beginning with the fiscal year 1924-25 progress has been steady, both as regards total production and in the amount refined. In the six-year period from 1924-25 to 1929-30 the output of oil refineries has more than doubled and last year it exceeded the 1913 figure by 66 per cent. The Azneft refineries produce about 60 per cent and the Grozny plants about 37 per cent of the total.

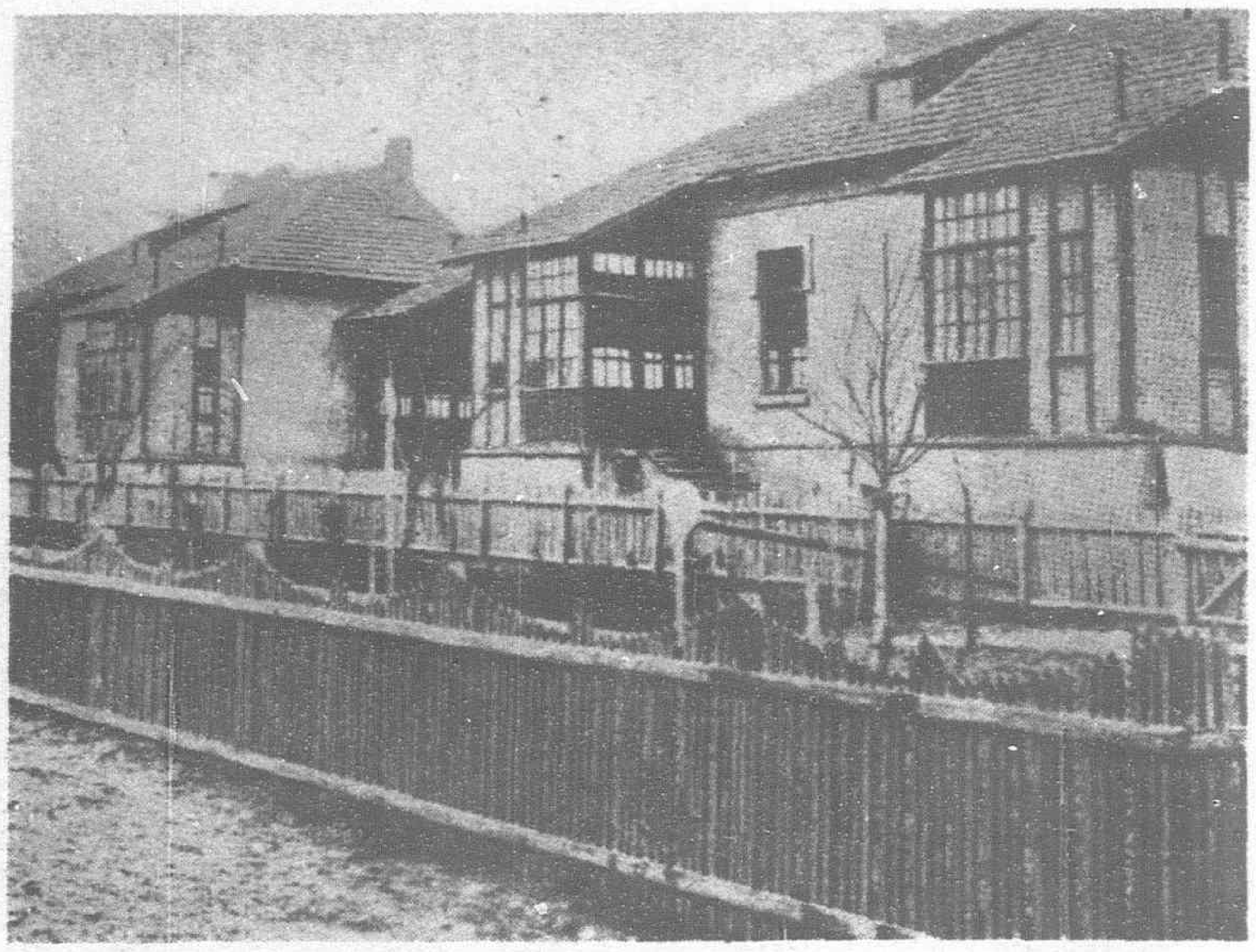


Graver Pipe Still Institution of the Azneft at Baku

The extensive introduction of modern refining methods and equipment dates from the fiscal year 1924-25. At that time the rapid growth in oil output began to exceed the capacity of the refineries. The increased domestic demand for tractor and automobile fuel and the prospects for the sale of large quantities of gasoline abroad called for an increase in the capacity of the refineries and a much greater production of gasoline. It was found necessary not only to restore and re-equip the old plants, but to construct many new ones and to organize production on an entirely new basis. Though there has been a steady increase in the percentage of oil refined, it is far from keeping pace with the exceptionally rapid increase in demand for refined products.

Oil Exports

Oil exports during the first six months of 1929-30 exceeded those for the corresponding period of 1928-29 by 38 per cent. The rapid growth in the importance of gasoline in the oil industry of the Soviet Union



Dwellings at Baku, erected for the workers of the Soviet Petroleum Trust "Azneft"

may be judged from the following table showing exports from 1913 to last year :

Exports of Oil Products

	1913	*1926-27*	*1927-28*	*1928-29*	*1929-30 (six mo.)*
	(in thousand metric tons)				
Kerosene	440.2	474.7	706.5	781.5	431.1
Gasoline and ligroin..	152.2	605.5	771.4	1,037.4	546.8
Lubricating oils ..	238.7	167.8	197.4	198.5	91.1
Solar oil	51.0	30.7	50.5	66.1	28.5
Crude oil	—	127.2	155.8	155.8	84.8
Fuel oil	65.6	550.0	699.7	1,128.8	768.6
Diesel and gas oil ..	—	125.0	206.3	257.8	173.4
Total	947.7	2,080.9	2,787.6	3,625.9	2,124.3

It will be noted that while in the pre-war period kerosene occupied the leading place in oil exports, constituting 46 per cent of the total, in 1928-29 kerosene exports amounted to only 22 per cent, the predominant position being taken by gasoline and ligroin, which in 1928-29 constituted 29 per cent of the total, as compared with 16 per cent in 1913 and 12.5 per cent in 1922-23.

Domestic Sales

The following table shows the sales on the domestic market of Soviet oil products for the three years up to 1928-29 and for the first half of 1929-30 :

Sales on Domestic Market

	1926-27	*1927-28*	*1928-29*	*1929-30 (six mo.)*
	(in metric tons)			
Gasoline	76,900	98,300	129,400	80,955
Kerosene	1,018,200	1,189,700	1,567,700	1,059,493
Diesel and gas oil ..	606,800	672,500	748,700	440,460
Lubricating oils	159,600	198,700	288,800	245,162
Fuel oil	3,863,200	4,434,500	4,825,000	2,880,857
Miscellaneous	199,500	212,600	217,200	—
Total	5,924,200	6,806,300	7,776,800	4,706,927

The domestic sales in the first half of last year were 29 per cent greater than in 1928-29. The domestic market also shows a growing demand for the higher class oil products. Thus, the sales of lubricating oils in 1928-29 increased over 40 per cent as compared with 1927-28, that of gasoline 32 per cent, and that of kerosene 30 per cent. The sales of other less valuable products have increased at a lesser rate. This increased demand for the higher-class oil products on the domestic market is due mainly to the great progress in the mechanization of agriculture, involving a rapid growth in the number of tractors, and also to the large gain in the number of automobiles and trucks.

In an effort to meet these increased demands it has been necessary to increase the gross production of oil, the proportion refined, and especially the proportion of gasoline and other higher-class oil products. Rapid progress has been made in this last direction during the last few years. While before the war gasoline constituted less than one per cent of the refined oil output, by 1926-27 it constituted 9.8 per cent and in 1928-29 it made up 12.7 per cent. This increase was attained almost exclusively by improvement in the methods of straight distillation, since the cracking process up to the past year occupied a minor rôle, only two cracking installations being in operation. From 1923 to 1927 the proportion of gasoline, kerosene and lubricating oils to the total refined oil output increased from 26 to 39 per cent.

In order to meet the rapidly growing demand for gasoline, reliance will be placed mainly on the development of the cracking process. The program for 1929-30 called for the construction of 14 new cracking plants. The construction plans for 1930-31 provide for over 100 cracking plants, and also for over two score pipe stills and refineries, 400 coke stills, etc. By the end of the five-year period (1932-33), it is planned to have constructed cracking plants with a total capacity of 18 million tons. Much of the equipment for these plants may be purchased abroad.

Trend of Development

The basic trend in the future development of oil refining in the U. S. S. R. is that of increasing to the maximum the extraction of gasoline and kerosene from crude oil. It is planned to increase the proportion of gasoline and kersoene in the total amount of oil refined to 46 per cent for the Soviet Union as a whole and to 65 per cent for the Baku fields. This considerably exceeds the present American figure. The total output of gasoline in the last year of the five-year period is set at 12 million tons, twelve times the output in 1928-29. The increase in output is to be obtained mainly by means of an extensive development of the cracking process. It is likewise planned to run an increasing percentage of the crude oil through the refineries. While in 1927-28 this percentage was only 75 per cent in 1930-31 it is expected to reach 95 per cent and in the last year of the five-year period close to 100 per cent.

The expanded program for total oil output calls for an annual increase of over 30 per cent. The revised plan for 1930-31 calls for a total production of 23 million tons, of which refined products are to constitute about 21 million tons ; and that for 1932-33 for a total of 42 million tons, of which practically all is planned to be run through the refineries.

It is planned to concentrate refining operations in close proximity to centers of consumption and export. Thus, the refineries at the ports of Batum and Tuapse will be steadily enlarged, so that by 1932-33 they should dispose of 35 per cent of the total refined products. Foreign markets demand primarily gasoline and the higher-class products ; consequently at Batum and Tuapse there are being constructed installations for cracking and for the complete treatment of crude oil.

The domestic market, on the contrary, demands at present chiefly kerosene and mazut, though the need for gasoline is expected to exceed the latter by the end of the five-year period. To meet the domestic demand it is proposed to construct a crude oil pipeline from the Caspian Sea to Moscow, where over one and a half million tons of the heavy oil from Baku will be treated annually in a refinery to be constructed. Another refinery is to be established at Samara for the treatment of about 650,000 tons of crude oil from the Emba fields. This plant will supply refined products to the Volga basin, the Ural district, and Siberia.

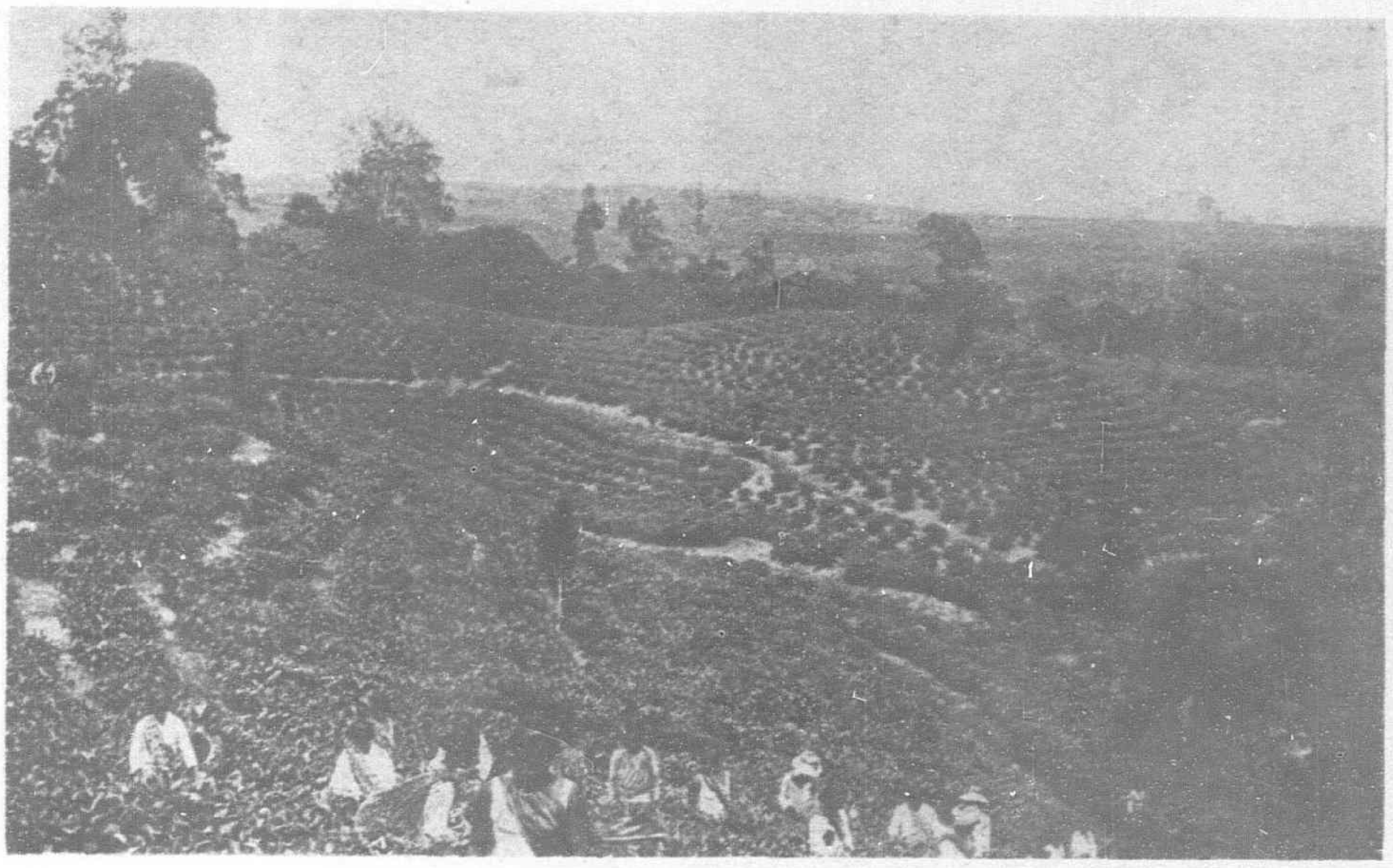
Thus the main product of the new refineries will be gasoline, obtained chiefly by the cracking process. The manufacture of lubricating oils of all varieties and compound greases will also be increased and the production of oil products hitherto manufactured in small quantities, or not at all, will be developed.

Modern Tea Factories in Java

Some Last Word Construction as Exemplified by Exhibits from Government's Tea Estate, Pasir Junghuhn, and by Pangledjar, the only Concrete Factory in Netherlands India

In recent years the Netherlands India tea industry has piled up a number of credits and not the least among them has been the building of some notable tea factories.

In 1930 alone three important factories were opened; Goenoeng Dempo in Sumatra and the Koleberes and Sedep factories near Bandoeng in Java. In August, 1930, the new factory Pasir Junghuhn, owned by the Dutch Government, was opened at Tjinjiroean, Pengalengan. It is possessed of many novel features. Then it must not be forgotten that Pangledgar, near Bandoeng, is the only concrete factory in Netherlands India.


Tea-plucking

Something about Pasir Junghuhn

Pasir Junghuhn is part of the Government's *Kina en Thee Onderneming* (cinchona and tea undertaking) in the Pengalengan highlands. The enterprise is included in the activities of the *Algemeen Landbouw*, or General Agricultural Syndicate, the head planters' organization of the Netherlands Indian Mountain Estates, with which is associated the work of the *Proefstation voor Thee* at Buitenzorg and the Tea Expert Bureau at Batavia.

Pasir Junghuhn was named after Dr. Franz Wilhelm Junghuhn, the well-known explorer and botanist, who, in 1855, was the first to realize the great possibilities of the Pengalengan Plateau, and who planted there the first cinchona gardens in Java from seeds of South American origin. Since then the district has become world famous for its prosperous cinchona and unrivalled tea estates.

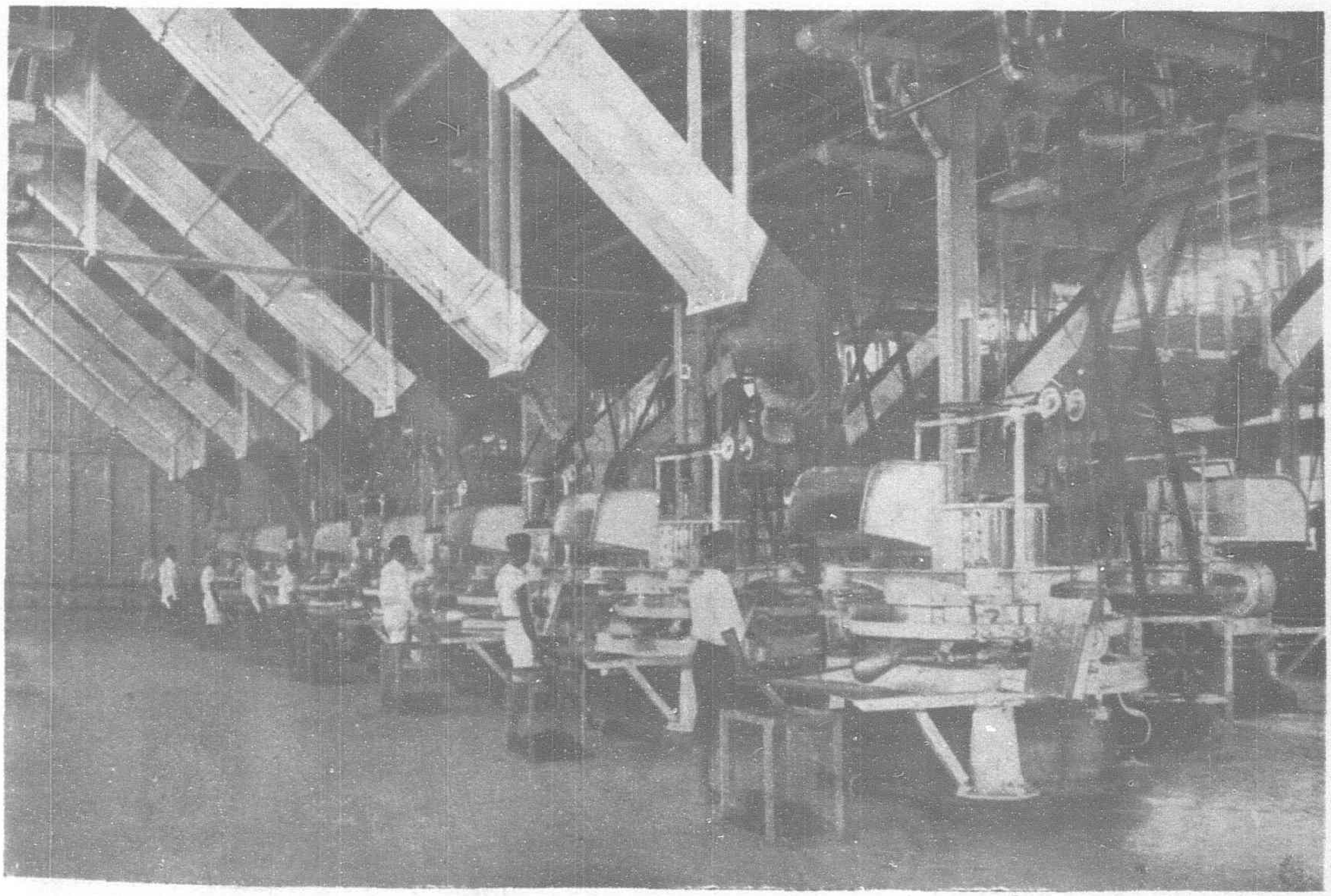
Dr. M. Kerbosch is head manager of the Tjinjiroean undertaking and Mr. M. A. van Roggen manager of Pasir Junghuhn.

A 1,250 Acre Estate

About five years ago, the Government planned an extension of its cinchona plantations, probably the largest in the world. However, cinchona bark prices slumped about that time, and there being no immediate prospect of their getting better the Government decided to open a model tea plantation and an up-to-date tea factory instead. At the time these proposals were made they met with strong opposition on the part of private tea estate owners. The chief objection seemed to be that private enterprise was fully up to modern methods and a model Government example was, therefore, not required. Nevertheless, the clearing of the forest was started in the middle of 1926, and in the first months of 1930 the tea planting was nearly finished, there being some 1,250 acres under tea.

The building operations were started in December, 1929, and the factory officially opened on July 24, 1930, by the Director of the Department of Agriculture, Dr. Ch. Bernard, well known as the former Director of the famous *Proefstation voor Thee*.

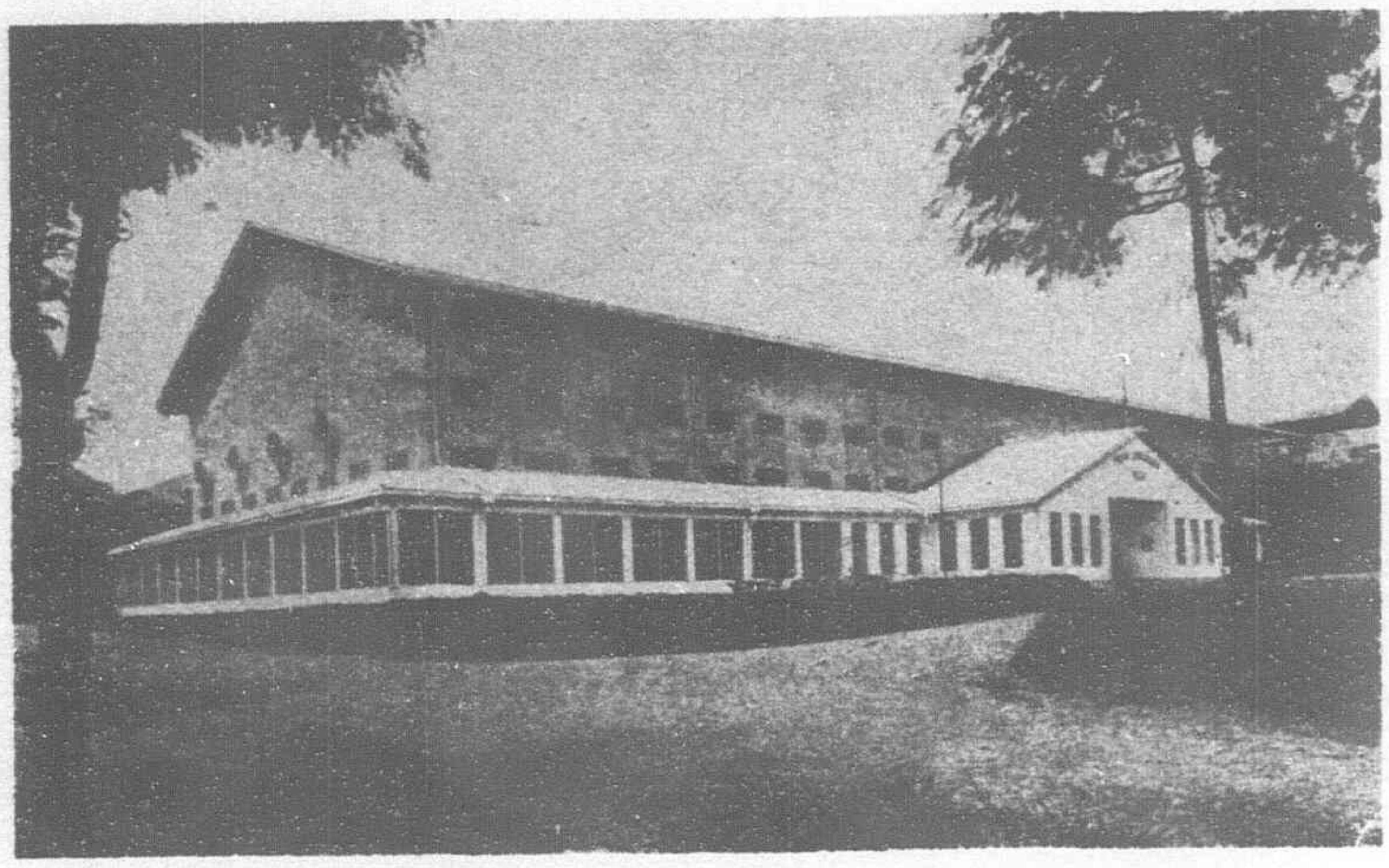
This factory was planned and built with scientific care and due regard for the latest hygiene. Throughout the ages the Dutch have been known for their cleanliness and the tea factories in Java and Sumatra lead the world in this respect. Pasir Junghuhn, in every detail of building and equipment, demonstrates that more than special care has been given to efficiency and hygienic ideals. It has the maximum of light and air. A new standard of modern tea manufacturing has been set by the Dutch Government at Pasir Junghuhn.


Interior of a Tea Factory

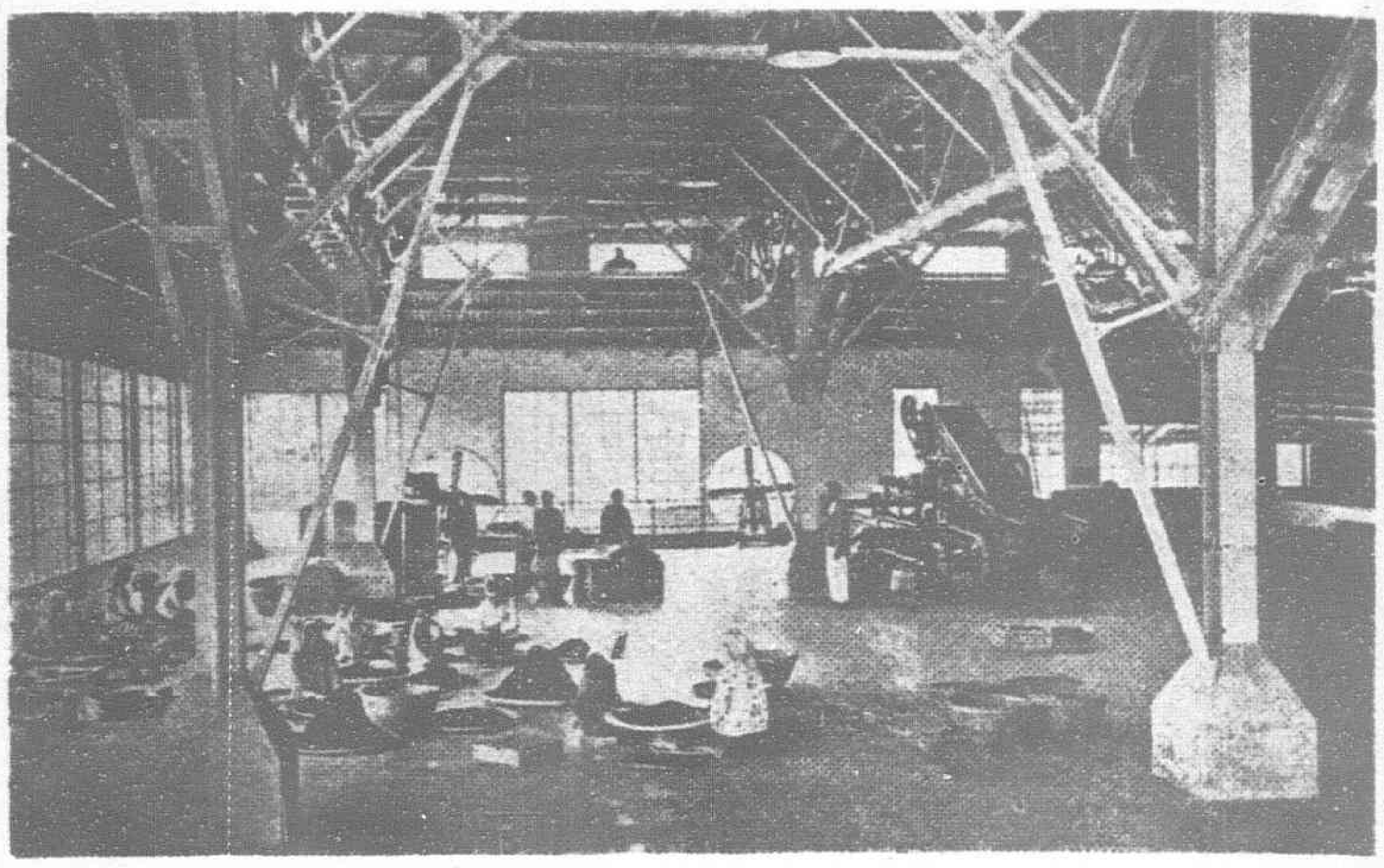
No Bruised Leaf

Excepting only the teak floors of the two upper stories, iron, glass and concrete are the only materials used in the construction. Particular attention has been given to mechanizing the transport of the fresh leaf as well as of the rolled and fermented leaf, the idea being to minimize the various manipulations and to avoid bruising the leaf during the most delicate phases of tea making.

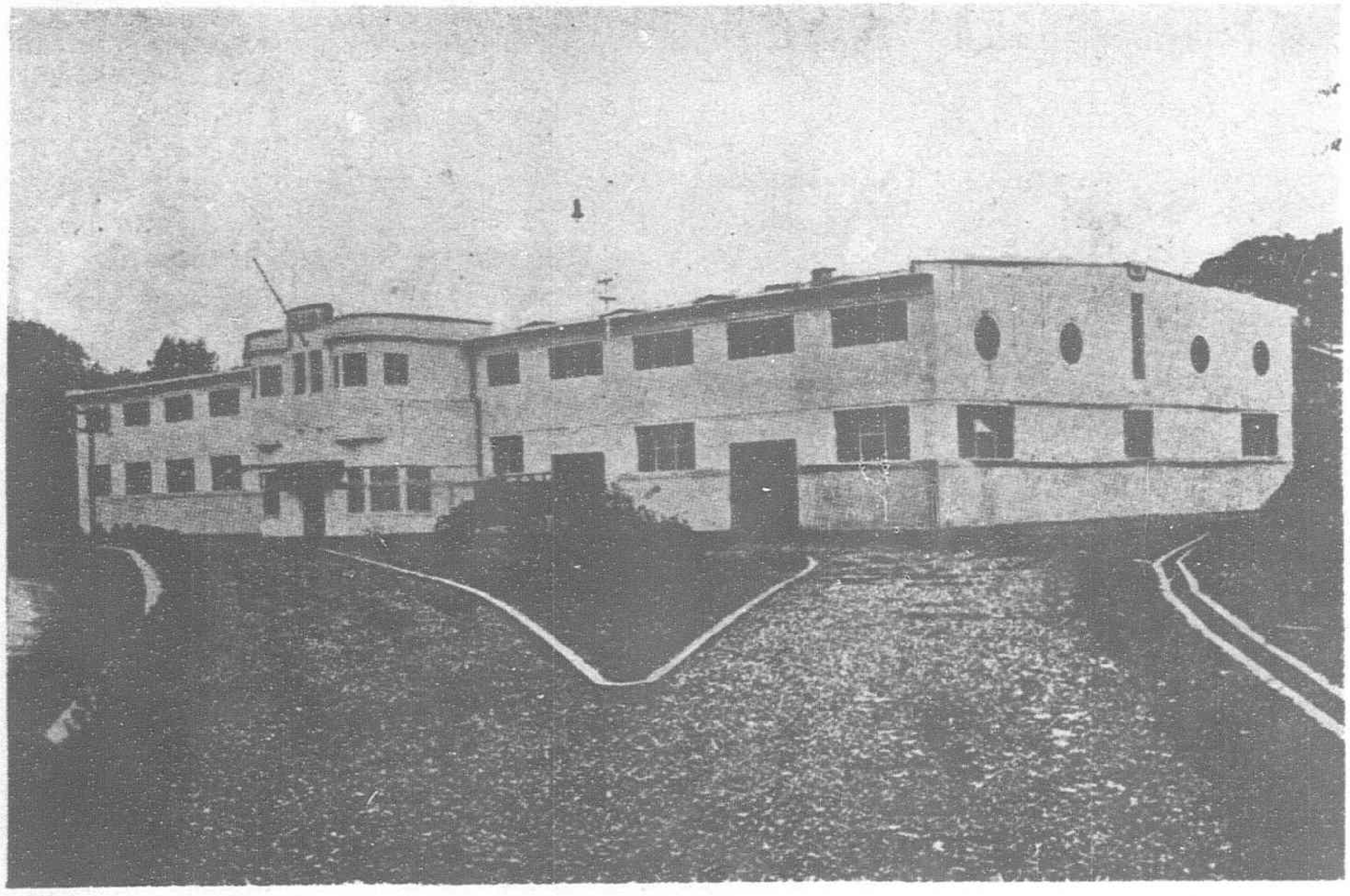
As the tea plants are still young, the present output of the estate is small, but with the whole area of 1,250 acres in full production within a few years the yearly output will be abuot 1,700,000 pounds of tea. Despite the difficulties always experienced in new tea factories, the made tea of Pasir Junghuhn has been above



Pasir Junghuhn in the Pengalengan Highlands



Sifting and Sorting Room at Pasir Junghuhn



Pangledjar, the only Concrete Factory in Netherlands India

the average quality since the start and continued improvement is reported. This year the first shipments will be brought to the Amsterdam market.

The tea factory was designed and constructed by the H.V. Machinefabriek Braat, together with the H.V. Technisch Bureau Sanders Birnie. Siemens supplied the material for the electric installation.

The equipment is arranged for the handling of small or large output with ample storage space. It includes Hollandia open-top and double-action automatic rollers, manufactured by the Reineveld factory at Delft. The trackage employed is the Tourtellier monorail system. The temperature in the double-walled fermenting room is maintained constant by a Sulzer heating installation and blower. Empire dryers and Java sorters are employed. The office is in the center of the factory.

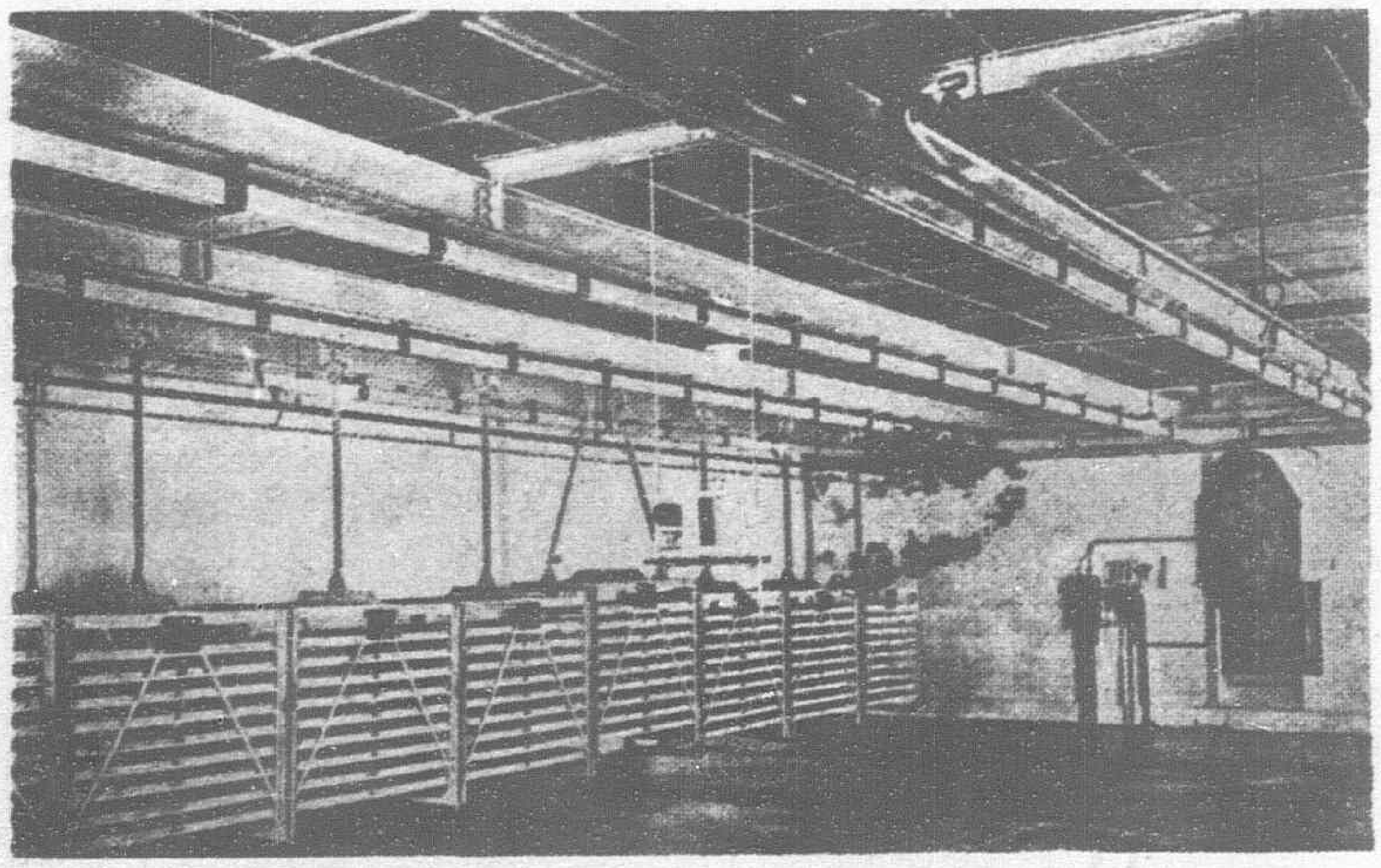
Describing the Illustrations

One illustration shows a front view of the factory. On the right background the fresh leaf is received, weighed, and transported by hanging monorail to the different sections of the two withering floors. After being rolled the leaves are sifted and transported in hanging sets of trays by another monorail system to the fermentation room.

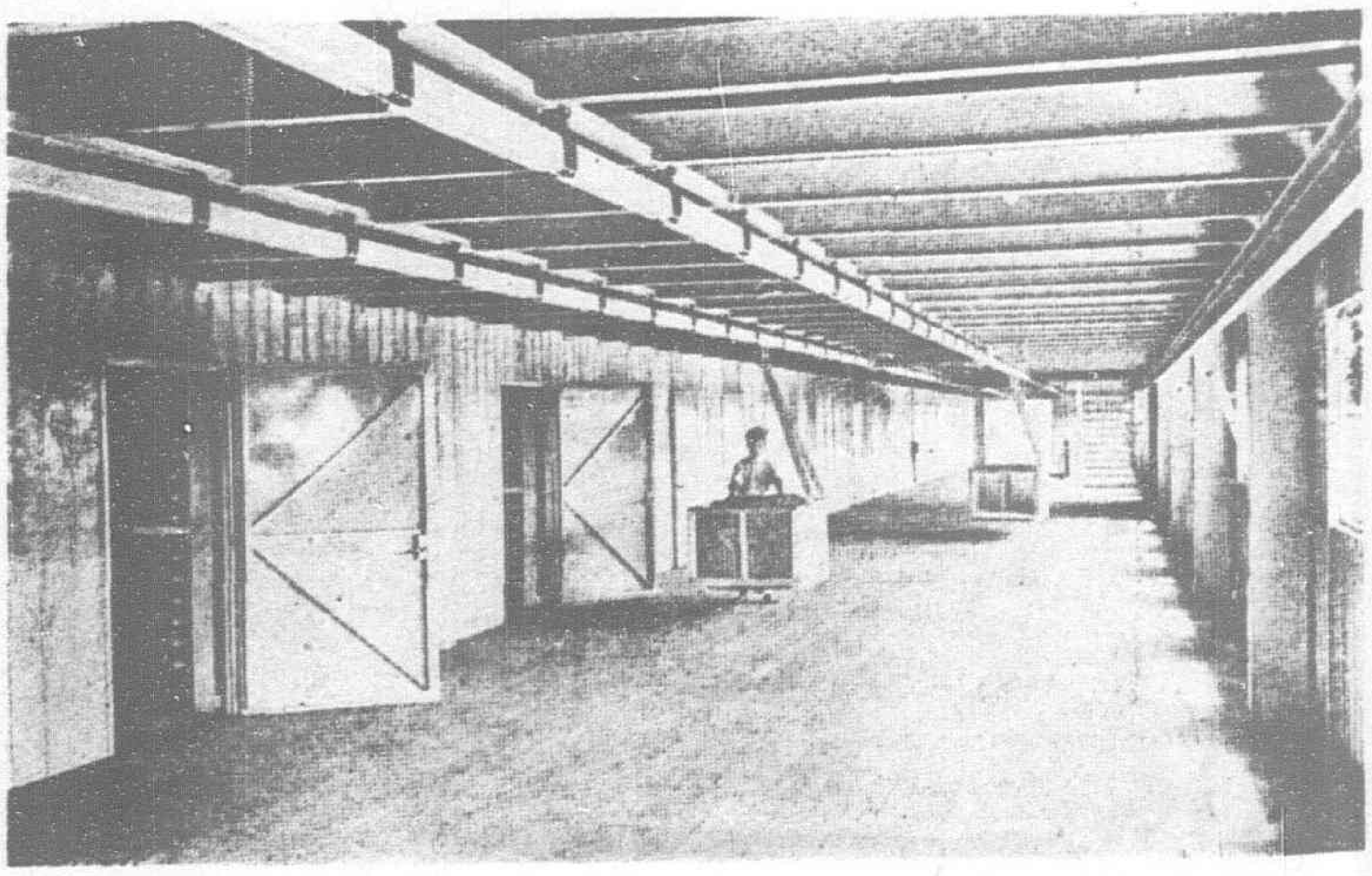
Another picture shows the fermentation room where the carefully controlled process of fermenting is stimulated by humidity produced by efficient water vaporizers and a temperature of 23° Cent. is maintained by electric hot air installation.

Still another illustration shows the sifting and sorting room where the dried tea is finally sorted, first by machine and then finished by hand, after which it is graded as Orange Pekoe, Broken Orange Pekoe, Broken Pekoe, Pekoe, Fannings, and Dust. Special attention is called to the fans for extracting from the air the cloud of dust which usually is associated with the final manufacturing process. The Dutch engineers consider that a fresh atmosphere and much light are the essential things here.

The Pangledjar factory, with its unique concrete construction, has attracted considerable attention from foreign visitors.



Hanging Sets of Trays containing Rolled Leaf in the Fermenting Room



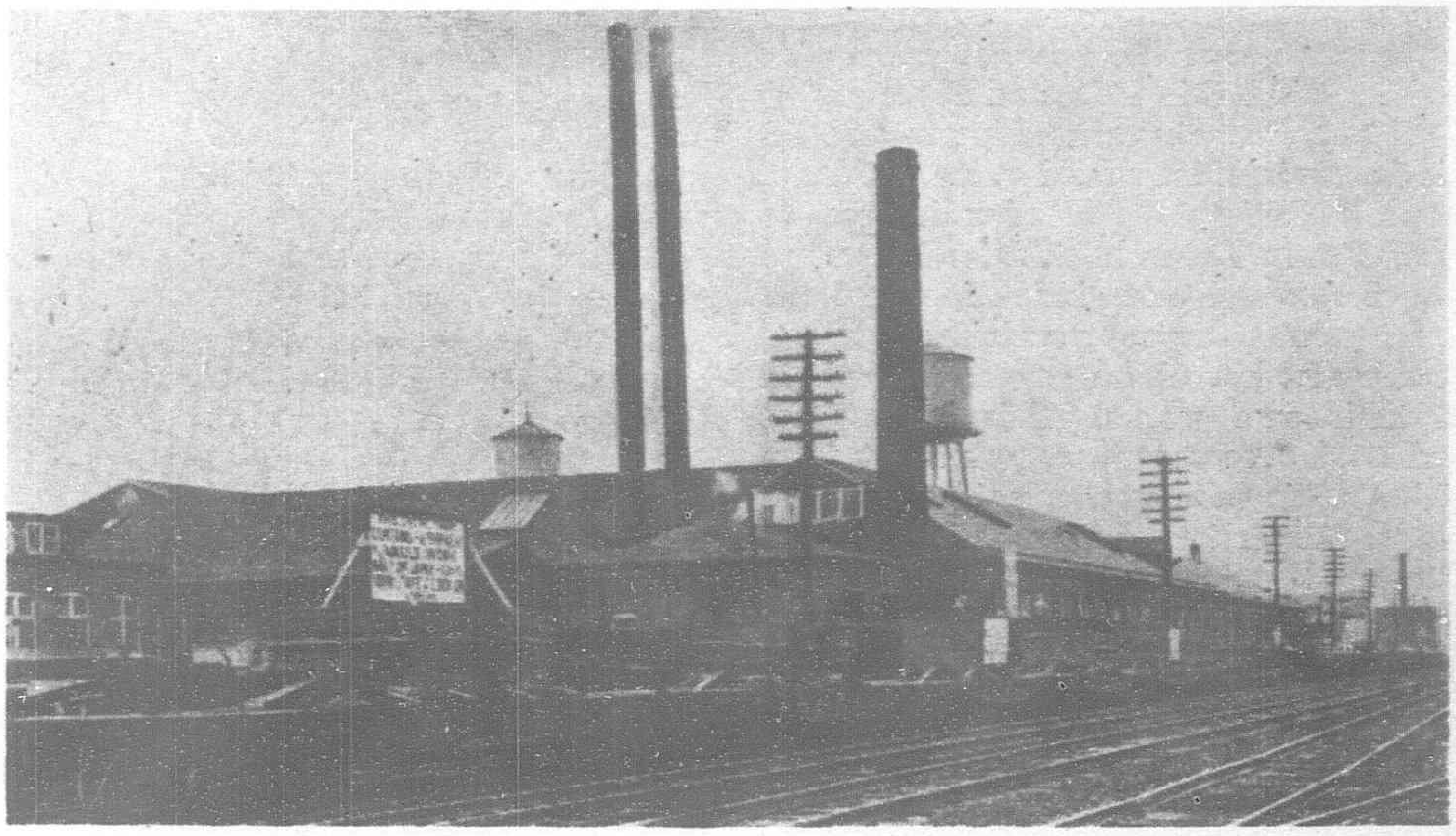
Green Leaf Arriving by Monorail at the Withering Lofts

Two Outstanding Undertakings

York Safe and Lock Company Building Largest Vault in World at Tokyo for Bank of Japan

Two outstanding undertakings in the Far East of the York Safe & Lock Company of York, Pennsylvania, U.S.A., are the installation of a massive circular steel door in the vault of the Kincheng Banking Corporation of Shanghai, the first work of the kind to be done in China, and the building of the largest bank vault in the world at Tokyo for the Bank of Japan.

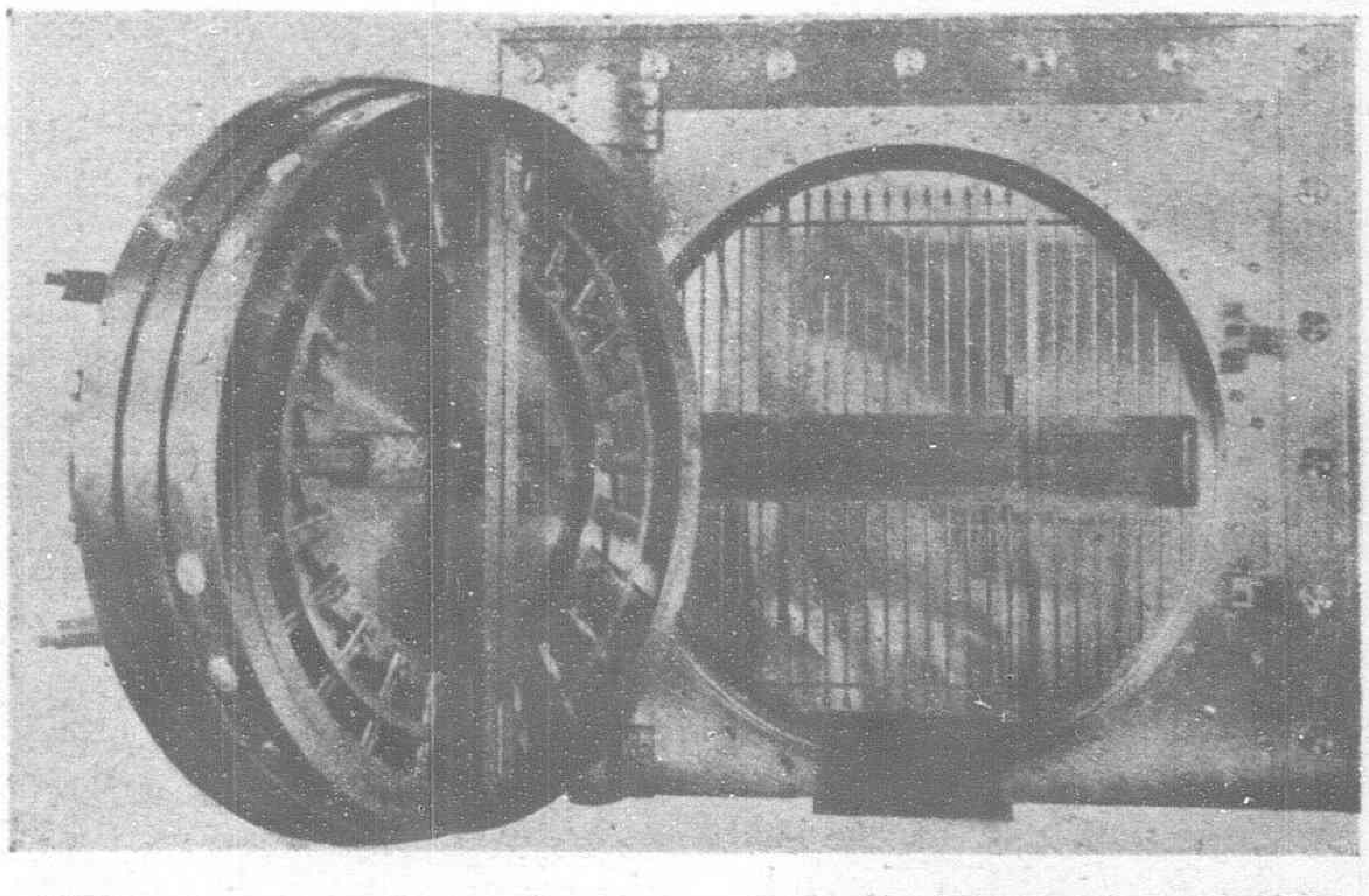
It is commonly known that the York Safe & Lock Company of York, Pennsylvania, has provided the vault doors and entrances for most of the American Federal Reserve banks and their branches, and that a very large number of the most representative banks of America have shown a preference also for the York output. But perhaps none of the installations it has made, not even the unique door for the vault at the Federal Reserve Bank in New York, has included quite so many interesting features, in the course of the job, as that which is now well on the way toward completion for the Bank of Japan.



Something like a year ago, that great financial institution concluded that the York company should provide the material for its new vault. That was a splendid recognition of the excellence of the York products, and also of the reputation York's work has gained outside of America. This vault is to be the largest vault in the entire world. Because of the immense worth of the money and securities it will hold, it must also represent the very last word in strength and in effective resistance to every conceivable method of attack.

Fourteen Vaults

The vault will be of two stories, each vault being 187 feet long and 84 feet wide. Inside, each vault is divided into seven vaults by steel partitions, making 14 vaults in all. There you have some conception of the size of the great structure that is to preserve so important a part of Japan's liquid wealth. You get rather more of a conception, however, of what a task the York Safe & Lock Company had taken on, when you learn that to this aggregate of 14 vaults, there are to be 17 doors. Six of the doors are 36 inches thick, and each of the other 11 are 24 inches thick. Into the construction of these vault entrances, material has been built for resisting every known method by which a vault can be attacked. The possibilities that drills and explosives will be used, or that the oxy-acetylene cutter burner will be brought in for the attack, have been thoroughly considered and defense against them provided in an adequate way. The danger of fire or flood or earthquake has not been overlooked and full provision against those possibilities has also been made. That modern nightmare, the possibility of mob attack, that was so clearly on the minds of the designers of our Federal Reserve banks, was also thoroughly considered, in this case. The outcome of all these studies and plans is a vault of wonderful strength, with York doors and entrances, with heavy reinforced concrete walls and with a steel lining, one and one-half inches in thickness, within the walls.



This entrance to the vaults of the Kincheng Banking Corporation in Shanghai

Two Full Train Loads

The York Safe & Lock Company had agreed to have the material for this vault ready in one year, and the shipment from York to Japan was made exactly on time. It was something of an event, when the material for the vault was being loaded on railroad cars at York and started on the journey half way around the world. The picture accompanying this article is impressive, but gives only a meager idea of the magnitude of the shipment. This train of thirty-eight cars, carried only one-half of the material for the vault, yet two engines were required to draw this solid train load of material. From York, the Pennsylvania Railroad hauled the train load to Baltimore. There the Osaka Shosen Kaisha Line loaded the material on its steamer *Tokai Maru*, which sailed for Japan on January 17. On April 22, 1931, York Safe & Lock Company made its second shipment of a full train load of the vault material for the Bank of Japan, that second train having 42 cars. As the train moved across country, recently, on its way to Baltimore, each car appropriately bore a huge sign stating, "This entire train contains one-half shipment vault work Bank of Japan, Tokyo. York Safe & Lock Company, York, Pa." There could have been no more interesting evidence than this, for the American people to see, as this train passed through their town that American vaults have acquired a world-wide reputation.

The company's own erector, Oscar Schmidt, Jr. is now in Japan to superintend the installation of these vaults. The care and thoroughness with which the work will be carried out is apparent, since this installation will probably keep him in Tokyo for almost or quite an entire year.

The front of the big vault is 20 meters wide. The total weight of materials will be 3,000 tons, the main doors alone weighing 30 tons each. It is located about 40 feet underground.

(Continued on page 460).

Japan's Automobile Industry*

By MASAO SHIBUSAWA, President, Ishikawajima Motor-car Works

Automobiles were first imported into Japan about the year 1900, since when the demand for them has been steadily on the increase, until at the end of 1926 the number was 49,000, increasing in 1926 to 90,400. The question now before the industry is when the saturation point will be reached. It is rather difficult to gauge the situation by comparison with conditions abroad where the circumstances are very different. In other countries, national wealth, road conditions, areas, populations and so on have to be carefully considered ; but in Japan this aspect of the question is not hard to estimate. Roughly speaking, between 350,000 and 400,000 cars would be quite sufficient for the present needs of Japan ; but it will be ten years yet before the saturation point is reached.

Imports of automobiles in the past may be of some interest in estimating the future. The value of motor-cars imported in 1913 amounted to some Y.500,000 ; but the amount jumped to Y.10,000,000 in 1919, and to Y.20,000,000 in 1923, and Y.32,000,000 in 1928, but of this sum Y.18,400,000 represented parts and accessories ; while, of the total imports in 1929, valued at Y.33,550,000, parts and accessories represented Y.24,000,000 all of which goes to show the increasing output of cars in Japan herself.

The above figures represent cars appearing in the foreign trade returns of each year ; but for some years now such firms as the General Motors and the Ford works have been assembling cars in Japan, having established their own works. This output has reached between 20,000 and 30,000 cars a year, valued at from Y.50,000,000 at Y.60,000,000. This money was paid to foreign makers, but, of course, a large proportion of it went in wages to Japanese agents and workmen. But it may be said that about from 60 to 70 per cent of Japan's outlay on motor-cars goes abroad for imports, a sum far larger than appears in the usual trade returns. But as the operation of assembling cars in Japan is steadily on the increase, the balance of trade on this item must rapidly change.

The amount of money spent on purchasing new cars and in replacing old ones reaches about Y.150,000,000 a year at present ; and by the time 400,000 cars are required, (the saturation point), between 30,000 and 40,000 cars will be required in replacement of old ones ; hence the annual outlay will total something like Y.70,000,000. The problem now is whether this large sum will go to foreign car-makers ; for if it does, the national trade balance will be adversely affected on this account alone. Not only so, but, from a military point of view, it would be most unadvisable that the nation in any emergency should be dependent on foreign imports. Moreover, the automobile industry is to a large extent synthetic ; that is, it has a close bearing on many other industries ; so that the firm establishment of the industry in Japan is imperative for the safety of the nation.

What then are the prospects for safeguarding the motor-car industry in Japan and establishing it on a secure basis ? One must remember that, so far, the motor car industry in Japan has had to depend on tariff protection and on government subsidies. The chief manufacturers of cars are the following firms : The Ishikawajima Motor-car Works, established in 1919, with a capital of Y.2,500,000 having a capacity of 1,000 cars, and annually turning out 250 ; the Datto Automobile Company, established in 1926, with a capital of Y.465,000, a capacity of 400 a year, and an output of 130 cars ; the Motor-car Department of the Tokyo Gas and Electric Industry Company, established with a capital of Y.1,000,000 having a capacity of 300 cars annually, and making some 70 a year. Thus the total number of cars produced annually in Japan is in the neighborhood of 400.

In technique and mechanical equipment the Japanese car manufacturers are pretty well advanced, and their practical experience in the last few years has not been wasted. An interesting and significant feature of the domestic industry is that about 92 per cent of the materials used have been obtained in Japan, so far as aggregate value is concerned. But the meagre output does not render the undertaking a profitable industry. So long as a decent car made in Japan cannot be sold at less than Y.6,000 there is no hope of competing with such rivals as the Ford and the Chevrolet.

The more hopeful aspect of the situation for the future is that the industry requires expert skill and good mechanical motor power, both of which are coming to be more at the disposal of the Japanese who are naturally skilled artisans ; and electric power is cheap and almost everywhere available. The assembling plants of the foreign motor-car makers in Japan are largely manned by Japanese, with better results than those shown in the same works in the United States. The famous French car-maker, M. André Citroen, once said that when a car company owns from 100,000 to 150,000 cars, the industry is established in that country. In a few years the Japanese companies will have that many cars to their credit, and then the future of the industry will be assured.

The main question now is in regard to what Japan must still do in order to bring about the desired result and set the industry firmly on its feet ? Some time ago the Special Automobile Industry Committee of the Conference for Promotion of Domestic Industry gave careful consideration to this subject and as a result of its deliberations proposed a plan to the Minister of Commerce and Industry for the special protection of the motor-car industry in Japan. The chief points of the proposal were : (1) to push the manufacture of motor lorries and buses at first ; (2) to equip automobile works with a capacity for at least one thousand cars a year and gradually increase their capacity by at least 5,000 cars every five years ; (3) to fix standard specification so as to simplify operations and adopt a division-of-labor system ; (4) to utilize the machinery and experience already here as much as possible ; (5) and to consider carefully the official protection that can be given to the industry.

The reason for advising the stress on turning out lorries and buses, at the beginning, is that fashions in these vehicles change little, and they find a readier sale where they pay ; and such vehicles are not made by the foreign firms in Japan to any large extent, except by the Ford and the Chevrolet works. In the past, the Japanese makers have aimed at turning out only high grade cars, to sell at from Y.3,000 up, a decision arrived at in competition with foreign rivals. The idea in the above proposals, to have a further capacity of 5,000 cars every five years, was derived from examples in smaller motor-car works in America, where it was quite successful. By insisting on the division-of-labor system, the steel pressing would be done at the Japan Steel Works, the frames made at the local motor-car works, and the work finished according to a standard specification, thus achieving mass production. By this system of standardization and mass production American cars have been greatly reduced in cost and it is thought that the method would prove workable in Japan too. Of course such a system discourages the establishment of independent works.

The means to be adopted for the protection of the motor-car industry include the official encouragement of home-made vehicles, granting special exemption from taxation on the machine for a fixed period, granting preferential rights in charters taken out by manufacturers of cars or parts, and to those who run motor buses, and also to promote greater facilities for the sale and repair of motor-cars ; and then to see that the import duty on foreign makes be so fixed that the local industry can compete with the imported cars, foreign dumping being thus prevented.

Some time ago the Department of Commerce and Industry drew up a scheme for firmly establishing the automobile industry in Japan, at a cost of over Y.1,000,000 a year, embodying the principles outlined above ; but owing to the state of government finance the plan had to be shelved for the time being. The fact that Y.70,000 was asked for in the last session of the Diet to defray the cost of investigations concerning the subject indicates that the plan has not been dropped.

There is a firm conviction that in this matter of making their own motor-cars the Japanese are likely to be quite as successful as they have already been in other important industries, such as the paper industry, the making of Portland cement, the spinning industry, sugar making and many others, too numerous to mention. Within fifty years from the beginning of the Meiji Restoration Japan was able successfully to compete with Western countries in so many lines of industry that there is no reason to suppose she cannot equally do so in supplying herself with motor-cars.

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* *Japan Magazine.*

Radio Communication and Broadcasting in the U.S.S.R.

The use of the radio for commercial purposes is increasing rapidly in the Soviet Union as a result of the great economic development of the country. The main radio centers are Moscow, Leningrad, Kharkov (Ukraine), Sverdlovsk (Urals), Khabarovsk (Far East), Tashkent (Central Asia), Novosibirsk (Siberia), and Tiflis (Transcaucasia). In addition there are other centers of secondary importance.

District centers and important cities have broadcasting stations varying from 1 to 100 kilowatts capacity. There are now forty-seven broadcasting stations in the country. The main stations in Sverdlovsk, Tiflis, Kharkov and Tashkent are of 25 kilowatt capacity, while that of Khabarovsk is a short-wave transmission station of 20 kilowatts with a wave length of 70 meters. The Moscow broadcasting center has three stations of 100, 40 and 20 kilowatts, respectively. The erection of a giant 500 kilowatt station is projected near Moscow, which will be the most powerful in the world.

The Five-Year Plan provides for the construction of sixty broadcasting stations throughout the U.S.S.R. varying from 10 to 100 kilowatts in size. The parallel growth of telegraph, wireless and cable services provides the possibility of interchanging methods of communication, should this be desired. This is already done in case of events of great social significance. The Five-Year Plan also provides for radio-telephone and television service for all the basic centers. At present there is only one radio-telephone service in the country, that between Moscow and Sverdlovsk.

There is a general drive being made to provide all long-distance trains with radios. Up to the present time the best results have been attained on the Northern Railroad. Furthermore, the continuous and speedy development of the collectivization movement in agriculture makes it essential to extend the radio network to all agricultural centers, not only for amusement and educational purposes, but as a means of keeping the members of collective farms informed of economic progress throughout the country.

Local broadcasting stations are responsible for working out programs and ascertaining the special interests of the local population. They are also in charge of all technical equipment both for commercial and broadcasting stations.

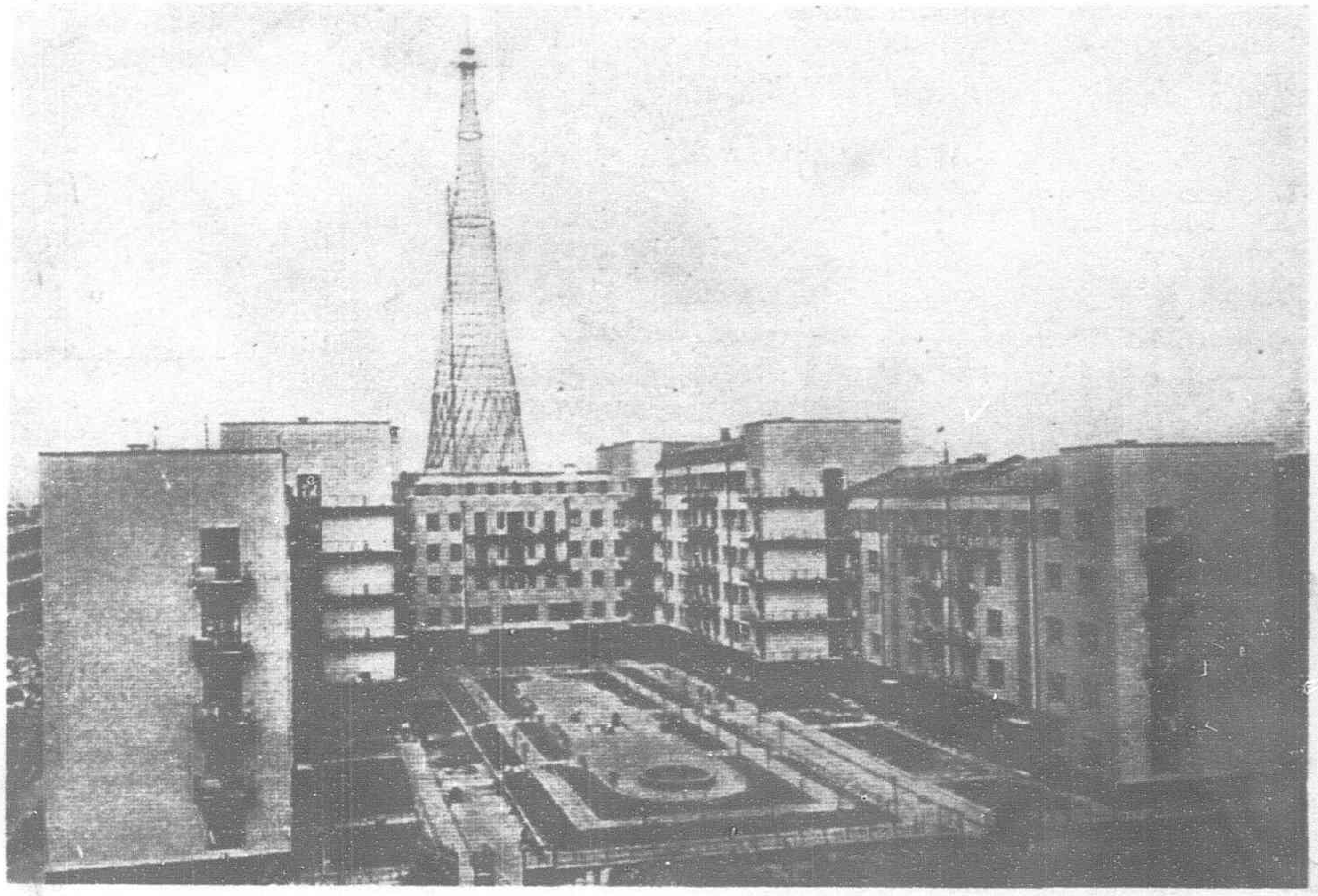
Central radio advisory councils are formed from representatives of the various social organizations. These councils usually meet monthly to receive replies to questions concerning the compilation of programs and to examine the broadcasting network. Programs are arranged as far as possible to conform to the requests made by the listeners-in. In this way there is popular control of the content of the radio programs.

The main programs comprise special items for workers, peasants, women, youth and army organizations, etc. Musical programs alternate with general political programs, news, lectures in foreign languages, talks on health, etc. In addition to the special programs there are those of a general artistic nature—orchestras, singing, etc. Every evening special events are broadcast from centers of public entertainment, such as concerts, operas and plays, as well as public speeches. In the national republics programs in the various languages are transmitted, with the view to raising the cultural level of the population.

As a result of the widespread desire for education among the working masses a special section for home-study courses has been established at the various radio centers. The so-called radio universities are organized on a large scale. There is also a special department which handles correspondence from listeners-in with suggestions for improvements, etc.

There are now more than a million licensed individual radio subscribers at present in the U. S. S. R., The fee for crystal sets is one rouble a year and for tube sets three roubles. In this connection, it should be borne in mind that, unlike in America and Western Europe, in the Soviet Union collective listening-in is much more general, for instance, in the thousands of clubs, reading rooms and schools. In addition to the crystal and tube receivers in the U.S.S.R. there are loud speakers at central points in cities, towns and villages. These may be seen at street-car terminals, public squares and buildings of importance. The number of listeners-in is expected to be 14 million by 1933.

The Society of Friends of the Radio publishes two journals which appear every five days, the *Radio Front* and *Radio in the Village*. Clubs and schools throughout the country have special study circles for instruction in all branches of radio work and every encouragement is given to students to join such circles.



Tower of the Shabolovsky Radio Station in Moscow—in the Foreground a Communal Apartment House

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Chinese Market for Scrap Metal

China is one of the world's largest markets for scrap metals. All kinds of these are used by the Chinese black-smiths and iron workers, whose output runs from farm and household implements and utensils to fine works of art. The United States has a fair proportion of this trade, principally because of the superior quality of the material, but all things being equal, importers seem to prefer European scrap, because of less difficulty in securing particular assortments of sizes and grades. Generally speaking, this European scrap is offered in lots with narrower tolerance than the American wire shorts, being offered in bundles of specified length and of not more than five stated diameters, for example, and, as this matter of selected assortment directly affects the profit to be obtained from each shipment, it can readily be seen that the Chinese importer will prefer that scrap material which will hold the best promise of gain. However, scrap wire is not the only material of this class against which there is local complaint. Plate cuttings are supplied from Great Britain in standard rectangular shapes only, while a lot of this material from the United States will usually include a variety of sizes and shapes and the edges will vary widely.—*U.S. Commerce Report.*

Engineering Notes

INDUSTRIAL

NEW PULP INDUSTRY.—A new pulp manufacturing company will be started soon by a group of Japanese business men who have secured permission to fell lumber in Saghalien for that purpose. They have a capital of ten million yen.

When the company starts business Japan's annual pulp imports are expected to be reduced by a half.—*Reuter*.

CHINA IMPORTS CHEMICALS.—In his annual report American Consul J. C. Huston, of Shanghai, states that Shanghai is consuming increasing quantities of industrial chemicals in its various plants and for divers purposes as is evidenced by the fact that in spite of adverse exchange during the year imports of chemicals increased from 6,166,493 in 1929 to 6,944,024 in 1930.

NEW FACTORY OPENED.—On the occasion of the opening of the new Dunlop factory built on the site of the old one at Kobe, Japan, for the manufacture cf tyres and every type of industrial rubber product, Sir George Beharrell, managing director of the Dunlop Rubber Co., Ltd., dispatched the following message of congratulation :—

" Board and directors of Dunlop Co., England, send warmest congratulations on opening of your magnificent new factory, which will fully maintain the quality of Dunlop products, and worthily symbolizes the industrial genius of two great friendly nations.—BEHARRELL."

SOVIET MOTOR CONTRACT.—A Stuttgart report says that a contract which is regarded as specially valuable in the present difficult economic situation, has just been awarded to the Daimler-Benz automobile works by the Soviet government. The order comprises 250 heavy trucks, costing altogether 2,500,000 marks, to be delivered by October 1. It is understood that the order was given after Soviet experts had thoroughly investigated the designs submitted by the company for a type of car destined for work under specially severe conditions.—*Trans-Ocean Kuo Min.*

WEIGHTS AND MEASURES.—The law governing the new standard of weights and measures was promulgated by the National Chinese Government on Feb. 6, 1929, and the new standard has been made the legal standard of weights and measures acceptable throughout China. For convenience sake and customary usage it established a double system ; one is the standard metric unit and the other, which is temporary in nature and to be abolished as soon as the people are accustomed to the use of standard units, is designed only for market use. However, the latter is derived from the former by taking one liter of *Kung Sheng* as one *Shih Sheng* which is nearest to the Chinese customary unit of capacity "*Sheng*" one half kilogram as one *Shih Chin* which is the average weight of the different varieties of "*Chin*" in different localities; and one third of a meter or *Kung Ch'ih* as one *Shih Ch'ih* which is the average length of different varieties of Chinese " Foot " in different localities, thus constituting the so-called 1-2-3-system of Chinese weights and measures based on International metric standard. Such a system as devised by the former Ministry of Industry, Commerce and Labor and proclaimed by the National Government to be put into force may also have great bearing on the users of British "Foot-Pound " system by taking the following approximate value : (1 quart equals to 1 liter, 1 pound equals to ½ kilogram and 1 yard equals to 1 meter. The Russian and Japanese system can also be thus varied accordingly so as to fit themselves to the International System).

SINO-CUBAN SUGARFACTORY.—The Chinese Central Political Council has approved the contract recently signed by the Ministry of Industries with Cuban sugar interests for the establishment of a gigantic sugar factory in Shanghai for the manufacturing of sugar. While the details of the contract with the Cubans are unavailable, it is generally believed that the Cuban interests will undertake to supply China with the equipment and other necessary materials for the producton of sugar by the factory.

CEMENT FIRMS MERGE.—The merger of the Nippon Portland Cement Company, capitalized at Y.10,000,000, of which Y.5,687,500 is paid up, and the Tosa Portland Cement Company, capitalized at Y.10,000,000 of which Y.6,400,000 is paid up, has been decided. The merger involves a ratio of 30.5 shares of Nippon Cement to 100 shares of Tosa Cement. Japanese cement circles will be divided among the Mitsui, Mitsubishi and Asano interests. Nippon Cement is closely associated with Asano Cement and its directors are those of the latter concern. It is one of the oldest cement companies in Japan but was forced to readjust in 1927, due to financial troubles. The whole institution was taken over by Asano Cement in that year.

NEW TEA FACTORY FOR SUMATRA.—The *Algemeene Indisch Dagblad*, of Bandoeng, Java, states in its issue of October 17, 1930, according to American Assistant -Trade Commissioner Carl H. Boehringer, Singapore, S. S., that the tea estate Tandjong Keling, at Pagar Alam, Palembang Upper Lands, Sumatra, owned by the Tandjong Keling Aktiengesellschaft, established at Zurich, is planning to build a new tea factory. The plans for the factory and attached buildings have been drawn up by the Advisory Bureau of Bandoeng, which Bureau has also made the plans for the new tea factories of the estates Poerbasarie and Gedeh. That Bureau is in charge of supplying the material and building of the factory. The project, which is highly praised by the director of the experimental tea station at Buitenzorg, has already been approved by the Swiss management. The factory will be built in two stages so that in 1932 it will have a capacity of 1,000,000 pounds of dry tea and in 1936 of 2,000,000 pounds. The factory will be equipped in the most modern fashion and mechanical transport will be applied as much as possible.

NEW MUNICIPAL BUILDINGS.—Arrangements for the eventual construction of new French Municipal Administration Buildings in Shanghai have advanced a further step, as the French Municipal Commission has decided to accept two offers for the sale of land near Avenue du Roi Albert, according to the latest of the official *Bulletin Municipal*. The first piece of land comprises cadastral lots 8515, 8516 and 8518, measuring 15 mow 6.2.7, and borders the north side of Avenue Joffre and the east side of Rue Lorton. The second piece adjoins the first, and comprises cadastral lots 8514, 8513 and 8512, measuring 20 mow 9.7.9., stretching between Avenue Joffre and Rue Paul Henry. The total size of the whole piece of ground is 36 mow 6.0.6. The French Municipal Council consider that this site complies with all the conditions required for central administration offices for the Concession, and it is large enough to permit the most suitable designs for the project. It touches three roads, two of them, Rue Lorton and Rue Paul Henry, having recently been constructed. The Council have decided to accept the offers of the China Realty Co. for the first piece of land, and that of Mr. Wang Fah-hao for the second, and the finance committee is now to decide on ways and means to pay the sums required. These, it is stated, are not large in comparison with prices recently paid for and in the vicinity.

JAPANESE STEEL RAILS.—A plan is now under contemplation by the Yawata Steel foundry to produce rails so as to prevent the import of foreign products entirely. The T. and high T. type rail which is being produced by the Government foundry is more than sufficient to meet the domestic demands and even to be exported to Shanghai, whereas the guard rail and other rails used in the electric railway track in the six greatest cities of the country are all foreign products imported to the annual amount of 100,000 odd tons.

GAS SALES AT HONGKONG.—The quantity of gas sold at Hongkong increased by seven million c.ft., but remained six million less than for 1928. At Kowloon the sales were 12 millions higher than for 1929. The report of the Hongkong and China Gas Company shows that the company's financial operations were seriously affected by exchange, as the value of the dollar fell from 1s. 7½d. on Jan. 1 to 1s. 1d. on Dec. 31. The question of stabilizing the dollar is under consideration in the Colony ; meanwhile, the Board are doing all that is possible to cope with the abnormal situation. The Directors recommend a dividend for the year at the rate of 5 per cent per annum, less income-tax. This was paid as an interim dividend on October 17 last.

NEW AMERICAN-JAPANESE FIRM.—Considerable interest has been aroused over the formation of a new American-Japan joint corporation, on June 27, with the Sakuma Building Materials Works as its nucleus, for the purpose of manufacture and distribution of roofings and other building and water-proof materials.

Negotiations were started some time ago between the Sakuma Building Materials Works, whose plants are located at Senju, Tokyo, and officials of the Paraffin Company of America. Inc., and the agreement was consummated in the latter part of 1930. The new company was duly registered on June 27 under the title of the Sakuma-Papco Industrial Co., Ltd. The company is capitalized at Yen 1,000,000, of which Yen 750,000 is paid up. At the initial general meeting, Mr. Eikichi Sakuma, former president of the Sakuma Building Materials Works, was elected president and director, while Mr. Kozo Hayami was elected managing director. Representing the interests of the Paraffin Company of America, Messrs. C. Esdale, R. P. Alexander and John Gadsby were elected directors. Auditors of the new company are Mr. Kokichi Nakayama and Mr. Harold Colls. Mr. Jisaburo Kawaguchi, formerly of the Sakuma concern, is the manager.

JAPANESE EXHIBITS.—Three exhibitions representing recent technical and engineering developments in Japan were opened this year in Tokyo and Osaka, according to a report from Consul Leo D. Sturgeon, Tokyo. They were the Third Chemical and Industrial Exhibition, the Precision Apparatus Exhibition and the New Inventions Exhibition. About 800 firms and institutions participated in the Chemical and Industrial Exhibition (Tokyo), showing more than 60,000 kinds of chemical and industrial products which show marked advances over the products exhibited in the 1926 exhibition. Modern manufacturing processes for such products as smokeless powder, special apparatus for astrophotography by the Astronomical Observatory of Tokyo, and a wide array of chemicals produced by the iron and gas industries were features of the exhibition. In the Precision Apparatus Exhibition (Tokyo) more than 3,000 kinds of apparatus were shown 90 per cent of which were developed by Japanese scientists. The Inventions Show at Osaka covered articles ranging from housekeeping utensils to technical apparatus, such as picture transmission equipment and highspeed movie equipment. This exposition also attracted wide interest.—*Issued by the U. S. Department of Commerce.*

SHEET STEEL PILING.—With the Seitetsu Jo (Government Steel Works) producing 1,200 to 1,300 tons of sheet steel piling a month, which is the program for the rest of this year, competition in Japan with the imported product is expected to bring reductions in price, followed by increased use of steel piling, reports the *Iron Age*. The demand for piling has been increasing steadily advancing from 18,022 metric tons in 1927 to 23,767 tons in 1928, 28,551 tons in 1929 and 28,849 tons in 1930. The current quotation on steel piling is about Y. 150 ($73.95) a ton.

JAPAN BUYS GERMAN STEEL.—Japanese consumers have recently resumed buying in Germany on a larger scale than at any time this year, reports the *Iron Age*. In the last week of March more than 5,000 tons of wire rods have been booked for shipment to Japan by German mills, compared with a total of about 7,000 tons since Jan. 1. The average price of the wire rods just placed was £5 ($24.30) a ton, c.i.f. Japanese port. There has also been some business with Japan in tubing, light gage black sheets, hoops and structural steel. *Reuter's Trade Service* learns from Berlin that Japanese firms, including a shipyard and two steelworks, ordered machine tools in Germany to the total value of 3,500,000 marks. Deliveries were to be made in May and June.—(*Reuter.*)

DIVIDEND MAINTAINED.—At the thirty-fifth ordinary general meeting of Callender's Cable and Construction Co., Ltd., was held on June 17 at the Waldorf Hotel, London, W.C. Sir J. Fortescue Flannery, BT., D.L., M.INST.C.E. (the chairman) said that while they were not able to show the same degree of advancement this year, they were able to come before shareholders with confidence and congratulation that the company had fared so well in these depressing surroundings of bad trade throughout the world. After making every necessary deduction the directors were able for the 12th year in succession to recommend a dividend on the ordinary shares at the rate of 15 per cent per annum. They had done a very large trade in cables for new buildings, both in connection with a number of gigantic buildings of many storeys in towns, and in connection with comparatively small houses in newly developed areas in the country. Their foreign connection had not diminished, but the number of orders during the latter part of 1930 were undoubtedly affected by the international depression in trade. They looked forward, however, to the resumption of their Foreign and Colonial business in its full flow as soon as the inevitable recovery arose in trade. As to Great Britain they need not therefore, look with pessimism to the future, but might reasonably hope that with the general revival of trade cable making generally, and Callender's Company in particular, would not be the last to participate with profit to the customers, to the workers and to the shareholders.

SHIPPING AND SHIPBUILDING

SHIPPING AGREEMENT.—The Nippon Yusen Kaisha and the Kokusai Kisen Kaisha are reported to have reached the following agreement about their shipping service on the New York route :

1. On the outbound voyage the route from Manila as far as Hongkong will be under the control of the Kokusai Kisen Kaisha.
2. On the outbound voyage the Hongkong-New York service of the Kokusai Kisen will be placed under the management of the Nippon Yusen Kaisha.
3. On the inbound voyage, the Kokusai Kisen Kaisha will control the New York-Manila route service.—*Rengo.*

July 2.

Five private shipping companies in Japan, which are closely interested in the trade in the South Seas, have organized an association named the Marine Transport Society, the object of which is to prevent unnecessary competition among themselves and to develop the transport service.

The members of the Society will hold a weekly conference for the discussion of the details of their plan of campaign.—*Reuter.*

MOTOR SHIPS FOR NORTH GERMAN LLOYD.—The North German Lloyd will shortly order two more ships for Far Eastern service. They will probably be of about 12,000 tons gross, with a certain amount of passenger accommodation, but mainly intended for cargo carrying. It is said that the engines will either be of the M.A.N. or Sulzer design and will be constructed in Germany.

The tenders were received by the Norddeutscher Lloyd on May 20, and the order will probably be placed within the course of the next three weeks.

KAHOKU MARU.—The *Kahoku Maru* is 335 ft. long with a beam of 48 ft. 6 ins., the deadweight capacity being 4,500 tons. She is for the Dairen K.K. and will be equipped with Sulzer-type machinery constructed by the hull builders, the Mitsubishi Dockyard. Three other similar ships are being built, one at the Mitsubishi Dockyard and the other two by Mitsui & Co. In the latter a B. and W.-type engine of 1,650 b.h.p. will be installed.

NEW JAPANESE CARGO SHIPS.—The Mitsui Bussan Kaisha have laid down three motor ships to their own account at the Tama Dockyard. Two are of 6.600 tons d.w.c. and will be fitted in each case with an eight-cylinder trunk-piston B. and W.-type engine, constructed by the Mitsui Co., having cylinders 550 mm. bore with a piston stroke of 1,000 mm., and developing 1,850 b.h.p at 140 r.p.m. The third vessel, which has been launched and named *Nagisan Maru*, is of 5,300 tons deadweight capacity, and will be equipped with a nine-cylinder engine of the same type as in the previous vessels, developing 2,000 b.h.p. at 140 r.p.m.

RATIONALIZATION IN SHIPPING.—After prolonged discussions, the two great Japanese shipping companies, Nippon Yusen Kaisha and Osaka Shosen Kaisha, have come to an agreement under which each will discontinue certain lines which are duplicated by the other. Considering the present shortage of cargo, this is a very sensible idea, but the benefit to be derived is limited owing to the fact that there still remains competition both from other Japanese companies and from foreign ships. However, it enables the two big companies to rearrange their ships so that the one that still functions on the previously duplicated lines shall give better service. More significant than this temporary arrangement to keep off one another's principal runs is the fact that the N.Y.K. throughout these times of depression has been building newer and better ships of several classes so as to be well to the fore when trade is prosperous again, as well as to offer attractive terms while it is still dull.

ROTTERDAM LLOYD AND FAR EASTERN TRADE.—The affairs of the Rotterdam Lloyd, as outlined in their report for 1930, reflect the uncertain conditions prevailing in the East Indian trade during the year. The disorganization of the produce markets brought about a decline in homeward cargo offerings, and since the company were under contract to deliver large consignments for the Dutch East Indian Government, they were obliged to fix a number of vessels for homeward cargoes in the open market. Later in the year, when the volume of cargo continued to decline, several vessels were laid up. The report states that the growing industrialization of Japan and the Far East generally is having a serious effect upon the trade to that quarter. The gross profit on voyages amounted to 5,465,044 gls., compared with 8,364,979 gls. in 1929. After adding the balance carried forward, interest, insurance profit and unclaimed dividends, the total gross profit amounted to 6,730,473 (against 9,967,565) gls., out of which the following allocations were made : allowance for depreciation, 4,608,409 (5,740,250) gls. ; maintenance of idle tonnage, 241,831 (nil) gls. ; written off holdings in other companies, 500,000 (700,000) gls., and contribution to Netherlands Shipping Union, directors' fees and income tax, 176,281 (310,060) gls. ; leaving a net profit of 1,203,932 gls., against 2,733,785 gls. in 1929. A dividend of 4 per cent has been paid, compared with 9 per cent in the preceding year.

MANILA-NEW YORK LINE.—The Kokusai Kisen Kaisha's newly built *Kirishima Maru*, 5,959 tons, now on her maiden voyage to Manila, is expected to return to Yokohama shortly, after which she will start for New York. This is the first new boat to be placed on the Manila-New York route which has been operated by the Kokusai Kisen Kaisha.

NEW D.K.K. CARGO BOAT.—The D.K.K. new cargo boat *Shansi Maru* made her maiden appearance at Dairen in July fresh from the Tama Shipyard, Japan, where she had been built. She is of 3,200 tons, equipped with Diesels, being sister ship to the *Honan Maru*. Capt. Kajikawa is in command. The new boat is assigned to the Dairen-Hongkong-Canton line.

CONSERVANCY WORK.—Work on the conservancy of the Huai River will be started in the coming winter without further delay, it is learned at the Huai River Conservancy Board. It is stated that the carrying out of this gigantic engineering project will necessitate the expropriation of considerable areas of private land along the banks of the river. The owners will however be fully compensated in accordance with the Land Expropriation Law. Adequate compensation will also be given to owners whose land is temporarily occupied or used by engineers of the Board. The total outlay is estimated at $92,-180,000. It is also learned that in order to facilitate the carrying out of its plans for the conservancy of various waterways in the Huai River Valley, the Board is planning to organize a number of Conservancy Associations in the various provinces affected.—*Kuo Min.*

AVIATION

AIRPLANE FACTORY FOR CHINA.—Plans for the establishment of an aeroplane factory have been under negotiation between representatives of the Nanking Ministry of War and the German Junkers Aeroplane Company. A draft contract has been made and will be formally signed as soon as the approval of the National Government is secured. According to the agreement, the proposed factory is to have a capital of $3,000,000. Of the 3,000 shares to be issued, two-thirds will be taken up by the Ministry of War and one-third by the German Company.—*Kuo Min.*

LINK FORMOSA AND JAPAN BY AIR.—A regular aerial transport service between Japan Proper and Formosa will be initiated in the latter part of September and the Japan Transport Company, which is to take charge of the proposed service, is going to make a series of experimental flights between the two termini, namely Fukuoka and Tamsui, by means of an eight-seater Fokker type seaplane. The distance to be covered by the proposed aerial transport service is 1,600 kilometers. At first only mail matter will be carried, but later the service will be developed into an ordinary passenger service as well.

COMPETITION IN CHINA.—Keen competition in aerial service in China with Shanghai as the base is being put up among the Powers, and all important points in China will be linked with aerial routes before long, says the *Osaka Mainichi*, China also is making much investment for the development of aeronautics in the country, according to the newspaper. The *Osaka Mainichi* further reports : The Curtiss-Wright Company of America concluded an aerial service agreement with the communication department of the Nanking Government on July 8. 1930, and the China Air Transport Company started last year a regular aerial mail service between Shanghai and Hankow, using two planes. This aerial route will be extended to Ichang and Chengtu soon. The American concern also has the right to inaugurate a service between Shanghai and Canton, *via* Fuchow and Amoy, and also between Shanghai and Peiping *via* Nanking, Tsinan and Tientsin. The regular aerial mail and passenger service between Shanghai and Peiping was started on April 1.

Two Outstanding Undertakings

(Continued from page 455).

The vast proportions of the vault are carried out in the walls which are 36 inches thick all the way around. It is reported that a bank in New York has vault walls of 46 inches in thickness on one side but the vault now under construction for the Bank of Japan is the first large one to be bounded by four walls of 36 inches in thickness.

It is equipped with one of the new photo-electric cell devices which indicate by an alarm signal when the outside of the vault is approached. The slightest touch on the vault doors will also set off an alarm.

The great circular steel door that the York Safe & Lock Company has installed at Shanghai for the Kincheng Banking Corporation is eighty inches in diameter, sixteen and a half inches thick and weighs sixteen and a half tons. This door is so evenly balanced that it may be moved with the slight pressure of one finger.

The metals embodied in the construction of the huge door cannot be penetrated by drilling or melted by any known degree of heat. It gives adequate resistance to all such hazards as fire, flood, earthquake, burglary and mob attack. The door is secured by 24 special bolts each three and a half inches in diameter as shown in the accompanying illustration. These are locked by two Sargent and Greenleaf off-set spindle explosive proof combination locks. These are checked by a four movement 96-hour time lock that prevents entry into the vault for any specified period after the door has been closed up to 96 hours.

Jalainor Colliery To Re-Open

Jalainor Colliery on the Chinese Eastern Railway's Western Section, which was demolished by the Red Guard at the time of their attack on the North Manchurian borders in 1929, has been left in practical disuse since, but the Chinese directors of the C.E.R., Harbin, insisting upon the resumption of its operation, the Directorate finally supported the idea, the restoration work having been arranged to be commenced on July 1 at the estimate outlay of G.R.300,000.

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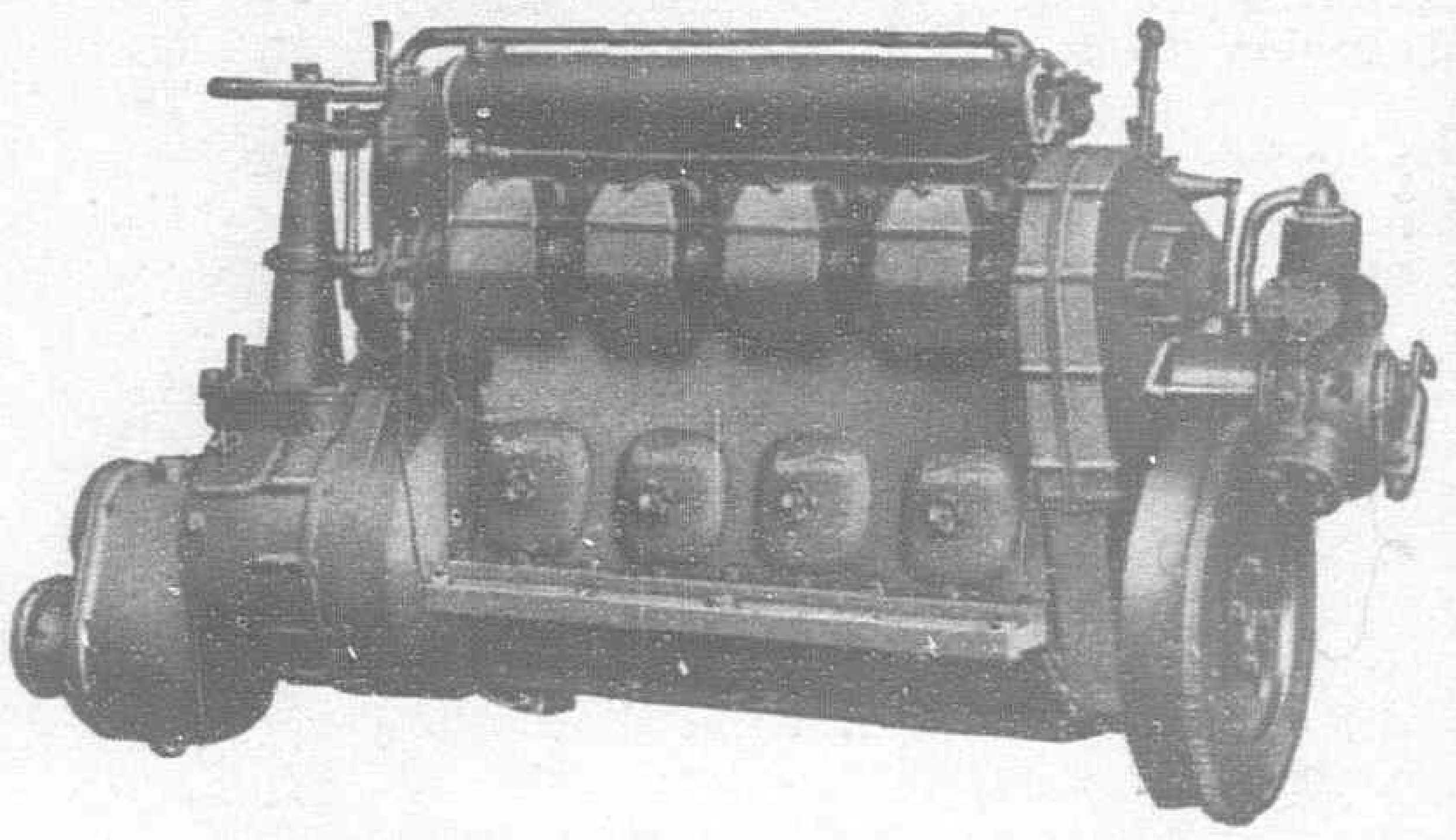

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